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Determinants of Climate Change Information Sources among Soybean Farmers in North East Nigeria

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Abstract

The study was conducted to determine climate change information sources among soybeans farmers North East Nigeria. Multi-stage random sampling technique was used to sample respondents while primary and secondary data were used for the study. A well-structured questionnaire was used to collect data from 450 soybean farmers. Descriptive statistic, was used to analyzed the data. Notice of climate change sign by soybean farmers revealed that most (43.6%) of the farmers noticed climate change about 5 years ago, many (27.6%) of the farmer noticed climate change about 15 years ago, and few (18.4%) of the farmers noticed climate change about 10 years ago. the implication of the result is that soybean farmers are knowledgeable about the changes that have occurred over the period of time in the study area. The soybean farmers revealed that extension agents (72.4%), radio (86.9%), television (83.1%), android phone (60.2%), farmers association and cooperative (82.2%), internet/email (53.8%), personal experience (86.0%), use of WhatsApp messages (58.4%), agricultural news-letters (74.7%), use of face-book (53.6%), and fellow farmers and relatives (84.7%) are their sources of information. The determinant of farmers perception on the effect of climate change on soybean production shows that with the weighted average of 4.007 many of the respondent feels/perceived stunted growth of soybean (4.28), delay flowering of soybean (4.13), early flowering of soybean (4.05), change in sowing time and maturity duration (4.09), reduction in germination podding and quality of soybean (4.00), were major effects of climate change on soybean production. Recommendation: The government should build the capacity of the extension agents in the area of ICT utilization so that the extension agents can be able to train the rural farmers in effective use of ICT in the area of climate change and other environmental issues.

Key Words: Determinants, climate, change, information, sources, soybean, farmers

Introduction: The continents of African abundant natural resources and agricultural potential, has not help many African countries like Nigeria from deep neck exporters of food crops and other consumer goods. With natural resources that is sufficient to meet the needs of the continent, Africa still imports food crops valued at over US$25 billion per year. Africa's high rate of poverty and over-reliance on imports of products and services are caused by the leaders and stakeholders who refused to engage in value addition, agricultural commodity processing, and postharvest management of the various crops produced in Africa (Moyo, Bah, and Verdier, 2015). However, a substantial portion of the continent's population still lives in sparsely populated cities and rural areas, where agriculture is their primary source of income. A little over two thirds of Nigeria's workforce worked in agricultural sector, which generated nearly three quarters of the country's total domestic revenue. The majority of Nigerians rely on agriculture for their primary source of income, hence raising living standards of the populace, depends on the sector's expansion and advancement in the agricultural sector. Encouraging growth can be achieved by effective use of information and communication technology (ICT), as ICTs are widely used in many nations where growth and an improved level of living standard of the populace are evident (World Bank, 2018). ICTs, which are necessary to successfully raise citizens' standards of living, are now widely adopted in Africa (Food and Agriculture Organization, 2017). As of 2019, more than 33 million smallholder farmers had access to digital apps; if the current trend of ICT usage continues, this number is expected to rise to more than 200 million by 2030 and using cutting-edge ICTs like block chains, artificial intelligence, cloud computing, Internet of Things (IoT), and big data analytics, along with traditional ICTs like computers, radios, TVs, and mobile phones, which are the current trends that is solving global economic and agricultural issues all over the world, food insufficient will be the thing of the past. ICTs have the potential to facilitate agricultural sustainability transitions by boosting output, for the good of humanity. Currently, a lot of countries use satellite technology and GIS to improve agricultural productivity. Example is Big data analytics which can be used to forecast climate changes in an area that can help farmers work more productively, influence decisions made in real time, and update their business procedures for the contemporary day (Wolfert, Verdouw, and Bogaardt, 2017; Ahoa *et al.*, 2020; Kassahun *et al.*, 2020). In Nigeria, the government is not able to supply farmers and community members with the knowledge, information, and proper learning methods they require for growth and development. Amidst all of this, extensionists are debating how best to use information and communication technologies (ICTs) to raise the standard of living and enhance rural livelihoods of farmers. Around the world, new agricultural technologies are putting pressure on traditional methods of supplying farmers with basic services, and ancient civilizations are being transformed into

knowledge-based society (Abiodun, Mauzonsu, Albert, 2022; Lightfoot, 2020). Nonetheless, Nigeria and other African nations' agricultural progress has been hampered by the low percentage of ICT adoption. The outdated Training and Visit distribution mechanism, which is no longer relevant or functional, is still used by Nigeria's national extension agency. Historically, mobile, movie theatre, video, television, radio, and phone introduction have all been used to support this service. Even at the headquarters ADP, most employees do not actually own a working Andro phone, as a result, despite the introduction and expansion of the global mobile communication system, the use of various ICTs, such as telephones, in extension delivery remains very limited (Othman, Alam, Melaiye, Shelleh and Rikwentishe, 2020). Agriculture provides a living for more than 70% of Nigeria's rural population and a small percentage of its urban dwellers. Because Nigerian agriculture is mostly rain-fed and prone to erratic rainfall variation, farmers find it difficult to organize their operations in a way that will both limit the consequences of climate change and produce a high yield (Ogbuabor and Egwuchukwu, 2017). Since many impoverished farmers in Nigeria rely on rain-fed agriculture and subsistence farming for their livelihood, climate change would affect every demographic in the country—income brackets, social classes, ages, and gender—in some way. Documenting farmers' perspectives, beliefs, and management approaches about climate change is necessary since, in comparison to other aspects, it is believed that these affect the effectiveness of coping strategies or measures of farmers in the rural area. In Nigeria, the government is not able to supply farmers and community members with the knowledge, information, and proper learning methods they require for growth and development. Amidst all of this, extensionists are debating how best to use information and communication technologies (ICTs) to raise the standard of living and enhance rural livelihoods of farmers. Therefore, research on the determinant of climate change information sources among soybeans farmers in North East Nigeria become important. The general objective of the study is to determine climate change information sources among soybean farmers in North East Nigeria. The specific objectives are to: evaluate years of notice of Climate Change signs by Soybean Farmers in the study area**;**.examine Sources of Information on Climate Change by Soybean Farmers in the study area **and** determine farmers perception on the effect of climate change on soybean production in the study area

The Study Area: The North East (often hyphenated to the North-East) is the one of the six geopolitical zones of Nigeria representing both a geographic and political region of the country's northeast. It comprises six State-Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe. The study will be carried out in Adamawa, Bauchi and Taraba State Nigeria. Adamawa is one of the largest states of Nigeria and occupies about 36,917 square kilometers. The Physical Setting of Adamawa State lies between latitudes 70 281-100 561 N and longitudes 110 301 - 130 751E**.** It shares its borders with Borno to the northwest, Gombe to the west, and Taraba to the southwest. To the east, it serves as the national eastern boundary with Cameroon. The Humidity and Temperature of Adamawa state, especially dry season, begins in November with a very hot period. The Harmattan period is experienced between December - February every year. Topographically, it is a mountainous land crossed by the large river valleys –Benue, Gongola, and Yedsarem. Population of Adamawa State as of 2006 was 3,178,950 and population projection as of 2016 was 4,248,436 (National Population Commission and National Bureau of Statistics Estimates 2016). In recent years, climate change in Adamawa State has begun to be more evident. Tropical wet and dry weather prevails in Adamawa State. The wet season lasts from April to October, whereas the dry season lasts for at least five months (November to March) yearly. An upsurge in rainfall in September in recent years is usually accompanied by floods with many people losing their life and properties due to both discharge of water from the Lagoo Dam in Cameroon and severe rainfall. The primary livelihood of the local population centers around agriculture, evident in their distinct vegetational regions, namely the sub-Sudan and Northern Guinea Savannah zones. They cultivate cash crops like Cotton and Groundnuts, alongside food staples such as Maize, Yam, Cassava, Guinea Corn, Soybean, Millet, and Rice. Communities residing along riverbanks are involved in fishing, and the Fulani people are known for cattle herding. The state boasts an extensive road network that connects its various regions with the rest of the country. Taraba state was created out of the former Gongola State on 27 August 1991, by the military government of General Ibrahim Babangida. Taraba state is bounded in the west by Nasarawa State and Benue State, northwest by Plateau State, north by Bauchi State and Gombe State, northeast by Adamawa State, and south by Northwest Region in Cameroon. Taraba State has an estimated land area of about 54,428 sq. km, lies between coordinates latitude 9º 3′ 32 ″E to 11º 55′ 3 ″E and longitude 6º 24′ 30 ″N to 9º 41′ 32 ″N Taraba State is in the Northeast geopolitical zone of Nigeria and lies largely within the tropical zone with a vegetation of low forest in the southern part and grassland in the northern part. Population of Taraba State as of 2006 was 2,294,800 and population projection as of 2016 was 3,066,834 (National Population Commission and National Bureau of Statistics Estimates 2016). The Benue, Donga, Taraba and Ibi are the main rivers in the state. They rise from the Cameroonian mountains, straining almost the entire length of the state in the North and South directions to link up with the river Niger

The climate of Taraba state is marked by an annual average Temperature of 33^0C but high level of cold in January and an increased rainfall in August. The percentage of rainfall in Taraba state is 40.35% with 54.98% relative humidity. The state is usually very warm in March with 40.44^0C, and an average wind of 8.84kmh | 5.94mph. The major occupation of the people of Taraba state is Agriculture. Cash crops produced in the state include coffee, tea, groundnut and cotton. Crops such as maize, rice, sorghum, millet, cassava and yam are also produced in commercial quantity. In addition, cattle, sheep and goats are reared in large numbers, especially on the Mambilla Plateau, and along the Benue and Taraba valleys. Similarly, the people of Taraba state undertake other livestock production activities like poultry production, rabbit breeding and pigs farming in fairly large scale. Communities living on the banks of River Benue, River Taraba, River Donga and Ibi, engage in fishing all year round. Other occupational activities such as pottery, cloth-weaving, dyeing, mat-making, carving, embroidery and blacksmithing are also carried out in various parts of the state. Bauchi State is located between latitudes 9° 3′ and 12° 3′ north of the equator with a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass. The state is bordered by seven states; namely Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east and Kaduna to the west. Bauchi is a city in northeast Nigeria, the

capital of Bauchi State, of the Bauchi Local Government Area within that State, and of the traditional Bauchi Emirate. It is located on the northern edge of the Jos Plateau, at an elevation of 616 m. Population of Bauchi State as of 2006 was 4,653,066 and population projection as of 2016 was 6,537,314 (National Population Commission and National Bureau of Statistics Estimates 2016). The Local Government Area covers an area of 3,687 km2 and had a population of 6,537,314 at the time of the 2016 population estimations. With the creation of Bauchi state in 1976, then comprising present Bauchi and Gombe states, it included 16 Local Government Areas. The number of Local Government Areas in the then Bauchi State was increased to 20 and later to 23. However, in 1997 when Gombe state was created out of Bauchi and additional local governments were created in the country, Bauchi State was left with 20 Local Government Areas. With a population about 5 million according to the 2006 census, Bauchi State has gone through a tremendous transformation since it was created. During the colonial era up to independence, it formed part of the Bauchi-Plateau of the then Northern Region, until the 1967 state creation exercise, when the Bauchi, Borno, and Adamawa provinces constituted the former North-Eastern State.

Bauchi state has two distinctive vegetation zones, namely, the Sudan Savannah and the Sahel Savannah. Sudan savannah vegetation covers the southern part of Bauchi state where the vegetation gets richer and richer towards the south, especially along water sources or rivers, but generally, the vegetation is less uniform and grasses are shorter than what grows even farther south, that is, in the forest zone of the middle belt. Sahel type of the savannah, which is also known as the semi-desert vegetation, becomes manifest from the middle of the state as one move from the state's south to its north. This type of vegetation comprises isolated stands of thorny shrubs. On the other hand, the southwestern part of the state is mountainous as a result of the continuation of the Jos Plateau, while the northern part is generally sandy. Bauchi state is a heterogeneous state, with predominant tribes like, Hausa, Fulani, Jarawa, Tangale, Waja, Balewa, Sayawa and Tarewa. It is made up of 20 local government areas, namely: Bauchi, Tafawa Balewa, Bogoro, Katagum, Alkaleri, Dambam, Giade, Ganjuwa, Darazo, Dass, Ningi, Shira, Gamawa, Itas/Gadau, Jam'are, Kirfi, Toro, Warji, Zaki, Misau. Bauchi state is an agricultural state. Its vast fertile soil is an added advantage for agricultural products, which include maize, rice, millet, groundnut, soybean and guinea corn. Irrigation farming is practiced and supported by the use of dams like Balanga dam, etc. Cattle and other livestock are also reared in the state. The state has industries like the Bazamri PVC – Wire Limited, Kuda Nails Factory, Yankari Natural Water Company, Zaki Flour Mills and Arewa Ceramic Industry and others.

Sampling Techniques and Sample Size: Multi-stage sampling technique was used to select the respondents for the study. In the first stage: from all six states of North East, three state were purposefully selected. The research work will make use of Agricultural Development Project (ADP) structure in the selected states. In the second stage: three ADP zones were purposefully selected from each state. The third stage: one block was randomly selected from each zone. The fourth stage: two cells were randomly selected from each of the blocks. From the blocks 150 soybean farmers were randomly selected from each block to make a total of 450 respondents from the three states Data collected for the study were arranged, coded and analyzed through the use of Statistical Product and Service Solution (SPSS). Descriptive tools were utilized to analyze the data. **Objective 1** which is notice of climate change signs on soybean production in the study area were analyzed using simple descriptive statistics like mean, frequency and percentage. **Objective 2** which has to do with to examine the sources of information on climate change by soybean farmers in the study area were analyzed using simple descriptive statistics like mean, frequency and percentage.

Objective 3 which have to do with to determine farmers perception on the effect of climate change on soybean production in the study area. Farmers perception was measured as: Strongly Agreed (4), Agreed (3), Neutral (2), Disagreed (1), Strongly Disagreed (0) and were analyzed using simple descriptive statistics like mean, frequency and percentage.

Results and Discussion: Years of notice of Climate Change signs by Soybean Farmers: The result in table 4.3 revealed that most (43.6%) of the farmers noticed climate change about 5 years ago, many (27.6%) of the farmer noticed climate change about 15 years ago, and few (18.4%) of the farmers noticed climate change about 10 years ago. the implication of the result is that soybean farmers are knowledgeable about the changes that have occurred over the period of time in the study area. Robert, *et al.,* (2019) who conducted a systematic review and resilience check of adaptation measures by small scale farmers and predicted worsening outcomes for future climate events, for example heat waves, drought and intense precipitation totally agreed with the result of this finding. Many studies shows that climate change has been occurring gradually over a long period of time now but since the effect was not drastic compare to recent years, farmers have not too noticed. But now the farmers are fully aware that the root cause of poor agricultural yield, productivity and erratic weather condition of their farming environment is majorly caused by climate change. The result in table 4.3 is in-line with Elisha *et al.,* (2017); Ebele and Emodi, (2016); Olaniyi *et al.,* (2019) who stated that for a very long time, Nigeria's climate has changed in many ways, and the government has paid little or no attention to these changes. Its inhabitants' lives are becoming more challenging, as seen by the rising temperatures, shifting rainfall patterns, rising ocean levels, catastrophic flooding, land degradation, an increase in the frequency of extreme weather events, compromised clean water supplies, and a decline in biodiversity. All economic sectors are feeling the effects of environmental degradation, but the agricultural sector is severely affected because crops and cattle—farmers' only sources of income—are in poor shape.

Sources of Information on Climate Change by Soybean Farmer: Sources of Information through the Extension Agents Table 2.2 indicate that majority (72.4%) of the farmers sources of information is the extension agents who visited they community time to time while few (27.6%) of the farmers sources of information is not through the extension agents. Information on new innovation and technology can easily reach the farmers through the extension agents as shown in the result of small-scale farmers in the study area. The result agreed with the finding of Tony, *et al.* (2023) who stated that Adaptation to climate change involves changes in agricultural management practices in response to changes in climate conditions as demonstrated by extension agents in their interaction with farmers in Benue State Nigeria. The climate change will be worst due to factors such as widespread poverty, over dependence on rain fed agriculture, inequitable land distribution, limited access to capital and technology, inadequate public

infrastructure, such as roads, long term weather forecasts and inadequate research in the area of agriculture as it relates to climate change. Table 2.2 revealed that majority (86.9%) of the farmers sources of information is through listening to radio whiles few (13.1%) of the farmers sources of information is through other medium apart from radio. The soybean farmers use radio to collect information because most of the time there are at the farm doing one agricultural activity or another. The radio is less expensive and portable which can be carried about from one place to another. Also, there are some radio stations that pass information in the local language of the farmers which make the farmers understand very well the ideas of the communicator or sender, radio is easy to operate and it is accessible everywhere. Although the radio has its own disadvantage which is the inability of the farmer to ask questions and send feedback to the sender. This has made many of the farmers to look for extension agents or co-farmers who can answer their questions. This result is in line with Oyinloye *et al* (2019) who stated that ICT have the potential to promote sustainability within the society at large. Radio which is one of the tools of ICT can be effectively deployed by extension agent or other stakeholders to communicate relevant information to rural farmers.In table 4.4 the farmers in the study area respondent that television is one ICT tools used by them to access information. 83.1 % of the respondents uses television as their sources of information while 16.9 % of the respondents do not use television as their sources of information because of cost of purchase and high cost of maintenance/repair of the television in case of spoilage or damage. The epileptic nature of electricity and high cost of energy are part of the reasons given by the very few farmers that are not using television as a source of information. This result is in line with Fariya and Farida, (2015) who stated that as opportunities to use ICTs grow, especially in developing and impoverished nations, the world cannot wait for costs to come down because international financing and multistakeholder cooperation are expected to invest in ICT to force the cost downward and that is why they are crucial in this scenario. Soybean farmers in the study area uses android phones in seeking and accessing information that are useful to their agricultural productivity. This is seen in the results below that majority (60.2%) of the farmers use android phones as sources of their information while few (39.8%) of the farmers do not use android phones as sources of their information. Because of the literate nature of the farmers in the study area they could access information through their phone as it relates to, they farm. Android phone is one ICT tool that has basically reduced the gap between the urban and rural communities in terms of information availability. Just as it has become a common knowledge that the world is a global village, it is because of ICT tool like android phone that made such knowledge true. Everyone holding an android phone today in his or her hands is carrying the entire world in his hand with the help of internet connection. The major population of the farmers sampled for this study have access to android phone that make it possible for them to access information related to soybean production and ways to overcome climate change effects. This assertion is in-line with the view of Abdulkadir, Maryam, Muhammed, (2017) who stated that in order to effectively warn the public of impending disasters like heat stroke or tsunamis, advise them on what to do in the event of an emergency or disease, and explain the amenities that are available should they become ill or need assistance, national danger and catastrophe prevention programs should integrate ICTs into every aspect of human operations. Most information about innovation and technology can sometime be quickly spread within community members through associations. According to table 1.1 majority (82.2%) of the respondent access information through the association they belong to like the farmer association while few (17.8%) of the respondents do not access information through the farmer association. Extension agents therefore should take advantage of the farmers' association in the study area and channel extension information and programs through their leaders and use them as local leaders, this will ease the extension agents work, minimize cost and wastage of resources in transportation and other logistics. Innovation will be more receptive as it gets to them through their various associations and leaders. As reported by Muhammad *et al.* (2019) that community leaders were highly effective in the performance of roles in their respective communities through ensuring that members of their communities are always carried along and/or benefit with all governmental intervention introduced in their communities. This is an application in ICT that can be use by farmers to access information for the growth and development of their agricultural activities. In this result it is noticed that 53.8% of the rural soybean farmers collected information using internet services while 46.2% of the rural soybean farmers do not use internet service as sources of information. This result agreed with Kassahun, *et al.*, (2020) who stated that when developing and evaluating programs, policymakers and the business community can effectively and affordably disseminate information about biodiversity to the end user using ICT application like the internet services. This application makes information get to many audiences as fast as possible at the same time, and accurate without ambiguity. We are living in the jet age when everything needs to be done very fast, farmers must not be left behind in food production and security. The study area has farmers that can be trained, equipped and empowered with little assistance from the government and they will go far in adding value to agricultural activities, growth and productivity. According to Akintonde and Shuaib, (2016) a farmer can forecast which crops will yield more in a situation like climate change if there is a lot of precipitation and less susceptibility to the weather. Farmers with suitable soils rushed to plant soybeans when the rains returned towards the end of August and the beginning of September of last year. This crop requires less rainfall and typically germinates in 12 weeks, so whatever rain falls during the remaining portion of the season should be sufficient to see the crop through to November harvest. This is in line with the finding of this research work who stated that majority (86.0%) of the respondent uses personal experience in forecasting crop to plant, date to plant, spacing and other agronomy practices while very few (14.0%) of the respondent do not use personal experience in their soybean production. It is understood that when you do a job over and over again you become master over that particular job so it is for many farmers in the study area. The soybean farmers were able to survival different climate change in the study area because of personal experience and knowledge. In table 2.2 the majority (58.4%) of the respondent uses WhatsApp messages as a source of information in their agricultural activities while few (24.6%) of the respondent do not use WhatsApp messages as source of information. The result is in line with Verdouw *et al.* (2019) who stated that the collection of hardware and software known as information and communication technologies facilitates the sharing, storing, and processing of pertinent information both within and between a particular population. WhatsApp message has been very effective in information sharing among the farmers and the extension

agents. Movement of stakeholders and other individual in and out of rural community has been hindered by insecurity over time, as such one of the ways pieces of information could get to rural farmers was through WhatsApp messages. In the study area most farmers are literate and could afford android phone that has this application which can be used to source information as it relates to agricultural productivity. In table 2.2 small scale farmers in the study area are trying their hands on so many communication tools and application including both traditional methods. The result show that 74.7 % of the respondents read agricultural news letters to get information as it affects, they farm while 25.3 % of the respondents do not read agricultural news letters to get information. The few that do not source information using agricultural news-letter may be due to their inability to belong to agricultural association, cost of buying the news-letter and they inability to read. Although as a people reading is not really our ways of life, we most time prefer to ask family and friends to explain to us what is written in a book. Around the world today, new agricultural innovation and technologies are putting pressure on traditional methods (newsletter) of supplying farmers with basic services, and ancient civilizations are being transformed into knowledge-based society (Abiodun, Mauzonsu, Albert, 2022; Lightfoot, 2020). Nonetheless, Nigeria and other African nations' agricultural progress has been hampered by the low percentage of ICT adoption. The outdated Training and Visit distribution mechanism, which is no longer relevant or functional, is still used by Nigeria's national extension agency. Majority (53.6%) of the small-scale soybean farmers access information through face-book group while few (46.4%) of the small-scale soybean farmers do not access information through face-book group. Extension agents, government agencies and all stakeholder can take advantage of this opportunity to engaged the farmers through this method of communication for effective and efficient results in the dissemination of useful agricultural innovation and technology. The assertion is in line with Menini and Carel, (2019) who stated that along with native information dissemination organizations, mobile phones, radio, television, print media, and other ICTs platforms are all actively used in agriculture production. All of this information is useful to farmers when choosing crops, figuring out when to plant and harvest, setting up irrigation, reducing the effects of bad weather like frost, low temperatures, and heavy rains, applying fertilizer, scheduling the use of pesticides and fungicides, and tending to livestock. Face-book group can be very effective because sender and receiver can actually interact and understand each other. Demonstration of new innovation can be done through the use of face-book and the receivers can ask questions on area of concerned. Furthermore, in table 2.2 majority (84.7%) of the respondent agreed to source information from fellow farmers and relative while few (15.3%) of the respondent do not source information from fellow farmers and relatives. This is the most common means where information can be passed from one person to another person because co-farmers and relative are always around the community and they can be easily accessed. This research work is in agreement with Robert, *et al*., (2019) who pointed out that in an attempt to adapt, some crop farmers have tried diversifying into nonfarming activities, and they are trying to discourage young people from getting involved in agriculture because they are more interested in white-collar employment.

Determinant of Farmers Perception of the Effect of Climate Change on Soybean Production: Table 3.3 indicate the perception of farmers on the effect of climate change on soybean farming or production in the study area. The data analyzed in table 3.3 shown that with the weighted average of 4.007 many of the respondent feels/perceived stunted growth of soybean (4.28), delay flowering of soybean (4.13), early flowering of soybean (4.05), change in sowing time and maturity duration (4.09), reduction in germination podding and quality of soybean (4.00), were major effects of climate change on soybean production. The study is supported by Tologbonse, *et al*., (2015) who worked on farmers' perception of the effects of climate change and coping strategies in three agro-ecological zones of Nigeria. General perception was that climate change increases the rate of crop performance, reduces family income and increase food insecurity among the rural community and the nation at large. The research work of Billore *et al.,* (2018) also supported the result of this finding by stating that with the growing climate change risk, development and adoption of climate-smart practices to improve resilience of soybean farming systems and livelihoods of soybean growers is inevitable. The climate resilient soybean production technologies includes efficient conservation and use of natural resources like soil, water and energy, genetic and crop diversity, reduced conservation tillage, integrated crop management techniques, use of microorganisms, crop residue management, managing sowing window, scouting for insect, pathogen and weeds, agroforestry, management of degraded land, capacity building and effective weather forecasting system etc. are enabling the farmers to minimize the risk of climatic adversities. On the other hands some of the variables that were below the weighted average of 4.007 include soil erosion (3.99%), increase in the cost of cultivation of soybean (3.92), high incident of soybean pest and diseases (3.86), post-harvest losses due to climate variability (3.89) and reduced yield of soybean (3.86) are perceived low by the respondent as effect of climate change. Although all the variables were rated as effect of climate change on soybean production in the study area but the respondent based on weighted average of 4.007 there are some variables that the respondent had high perception and other variable with low perception. The study is in line with Tony, *et al.* (2022) who stated that the common agricultural adaptation strategies used by farmers were the use of drought resistant varieties of crops, crop diversification, changes in cropping pattern and calendar of planting, conserving soil moisture through appropriate tillage methods, improving irrigation efficiency, and afforestation and agro-forestry. Also, Dupare, *et al* (2021) stated that adaptation practices of soybean growers toward effect of climate change in Central India has yielded positive results. The most widely practiced adaptation measure was change in the variety of soybean planted, change in time of farm operations and crop diversification. To cope with the insect-pest and disease attack on the crops, farmers adopted resistant varieties to minimize the cost of chemical spray. More than one-third of the sampled farmers practiced change in input application, while soil and water management practices were adopted by many of the farmers.

Conclusion: The soybeans farmers were able to notice the signs of climate change on their soyabeans farm production over a period of time. The changes have been noticed by some farmers over 5 years and 10 years as the case may be. The major sources

of information available to the soybean farmers in the study area include extension agents, radio, television, WhatsApp, internet/emails and fellow farmers/relative. The perception of farmers on the effect of climate change on soybean farming or production shows that stunted growth of soybean, delay flowering of soybean, early flowering of soybean, change in sowing time and maturity duration, reduction in germination podding and quality of soybean, were major effects of climate change on soybean production.

Recommendations: The government should build the capacity of the extension agents in the area of ICT utilization so that the extension agents can be able to code, decode, source, and train the rural farmers in effective use of ICT in the area of climate change and other environmental issues. The telecommunication companies should be encouraged to be deliberate in improving the rural communities ICT infrastructural facilities that can enable the farmer's access useful and relevant information for increased agricultural productivity. Federal government of Nigeria should take climate change challenges very seriously and formulate policies that can assist the farmers overcome its effect

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Table 3.1: Years of Farmers Experience in Noticing Climate Change

Years of noticing climate change by farmers	Frequency	Percent	Mean	Std. Deviation
5 Years ago	196	43.6	2.08	1.137
10 Years ago	83	18.4		
15 Years ago	124	27.6		
20 Years ago	32	7.1		
25 Years and above	15	3.3		
Total	450	100.0		

Source: Computed from Field Data 2024

Table 3.2: Sources of Information on Climate Change by Soybean Farmers

Variables	Frequency	Percentage (%)	Mean	Std. Deviation
Extension agents				
Yes	326	72.4	.72	.447
No	124	27.6		
Radio				
Yes	391	86.9	.87	.338
No	59	13.1		

Television				
Yes	374	83.1	.83	.375
No	76	16.9		
Android phone				
Yes	271	60.2	.60	.490
No	179	39.8		
Farmers associations/societies				
Yes	370	82.2	.82	.383
No	80	17.8		
Internet/E-mails				
Yes	242	53.8	.54	.499
No	208	46.2		
Personal experience				
Yes	387	86.0	.86	.347
No	63	14.0		
WhatsApp messages				
Yes	263	58.4	.58	.493
No	187	14.6		
Agricultural news letters				
Yes	336	74.7	.75	.435
No	114	25.3		
Face-book group				
Yes	241	53.6	.54	.499
No	209	46.4		
Fellow farmers and relatives				
Yes	381	84.7	.85	.361
No	69	15.3		
Total	450	100.0		

Source: Computed from Field Data 2024

Table 3.3. Farmers Perception of the Effect of Climate Change on Soybean Production

S/N	Effect of climate change on soybean production	SA (%)	A (%)	N (%)	D (%)	SD (%)	mean	Std. Deviation	Decision
1	Stunted growth of soybean	187 (41.6)	224 (49.8)	25 (5.6)	7 (1.6)	7 (1.6)	4.28	.771	High Perception
2	Delay flowering of soybean	126 (28.0)	270 (60.0)	43 (9.6)	7 (1.6)	4 (0.9)	4.13	.709	High Perception
3	Early flowering of soybean	128 (48.4)	249 (55.3)	50 (11.1)	15 (3.3)	8 (1.8)	4.05	.829	High Perception
4	Change in sowing time and maturity duration	123 (27.3)	273 (60.7)	28 (6.2)	22 (4.9)	4 (0.9)	4.09	.778	High Perception
5	Reduction in germination, podding and quality of soybean	127 (28.2)	240 (53.3)	52 (11.6)	17 (3.8)	14 (3.1)	4.00	.911	High Perception
6	Soil erosion	114 (25.3)	249 (55.3)	65 (14.4)	13 (2.9)	9 (2.0)	3.99	.834	Low perception
7	Increase in the cost of cultivation of soybean	121 (26.9)	211 (46.9)	89 (19.8)	20 (4.4)	9 (2.0)	3.92	.906	Low perception
8	High incident of soybean pest and diseases	114 (25.3)	197 (43.8)	106 (23.6)	27 (6.0)	6 (1.3)	3.86	.911	Low perception
9	Post harvest losses due to climate variability	119 (26.4)	210 (46.7)	89 (19.8)	18 (4.0)	14 (3.1)	3.89	.945	Low perception
10	Reduced yield of soybean	120 (26.7)	205 (45.6)	86 (19.1)	19 (4.2)	20 (4.4)	3.86	1.004	Low perception

Note: N=450, SA=Strongly Agreed, A=Agreed, N=Neutral, D=Disagreed, SD=Strongly Disagreed. Weighted Average=40.07/10=4.007

Source: Computed from Field Data 2024