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THE ROLE AND PERCEPTION OF EXTENSION AGENTS ON CLIMATE CHANGE: AN IMPLICATION TO MITIGATING AND ADAPTIVE STRATEGIES IN KADUNA STATE, NIGERIA.

Okwuokenye[1], G. F. and G.O. Ikoyo-Eweto[2]

[1]Department of Agricultural Economics and Extension, Faculty of Agricultural Sciences, National Open University of Nigeria, Km 4, Kaduna Zaria Express Way, Kaduna State.
Email: okwuokenyegoddy@gmail.com or ofolunsho@noun.edu.ng (Corresponding Author)
Phone No.: 08037568724
[2]Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria. Email: omogho4@yahoo.com, Phone No.: 08037470900

Abstract

The study analyzed extension agent's perception and role to mitigating climate change effects on agricultural production through adaptive strategies in Kaduna State, Nigeria. The study adopted multi-stage sampling technique to get 85 respondents that were used to collect information on primary data. These were analyzed using simple descriptive and inferential statistics. Results revealed that the extension agents level of awareness to climate change was low and various roles like capacity development of the farmers (mean = 3.07), providing information to farmers on new varieties of crops and breeds of animals that can adapt to climate change (mean = 3.03) and dissemination of innovations on best practices in climate change management (mean = 2.96) were carried out by the extension agents to the farmers to mitigate climate change. Also, several adaptive strategies like planting new and improved crops varieties and animals' species that are resistant to climate change (95.29%), apply modern production management and practices (91.76%) and use of climate information and forecasting (84.71%), adopted by the farmers to alleviate or mitigate against the effects of climate change. Results also revealed that incidence of pest and diseases (mean = 3.68), decrease in yields of crops and animals (mean = 3.66) and premature ripening of crops (mean = 3.42) were some of the perceived effects of climate change on agricultural production. The study found age, educational status, marital status, household size and working experience to be significantly related to their perception of climate change on agricultural production. The study thus recommended that; extension agents should do well to drive down to the farmers the necessary adaptive strategies that would help to curb the effects of climate change and that there should be increased campaign on the need to sensitize the extension agents and farmers on climate change and its effects

Keywords: Animals, climatic factors, crops, environment, food security

Introduction

Our environment has for some time now been affected by serious changes in climatic factors: namely, rainfall, sunshine, wind, humidity and temperature. The changes in these climatic factors and sometimes human activities such as burning of fossil fuel, indiscriminate bush burning and deforestation that increase the carbon dioxide in the atmosphere have resulted in climate change (Idumah, *et al.,* 2016). Climate change is being defined as change in climatic factors or climate for a period of at least 35 years (Emaziye, *et al.*, 2022). Climate change has brought about serious threat to the environment and to man, manifested in the form of drastic reduction in agricultural production leading to hunger, malnutrition, disease and poverty in Nigeria in particular and Africa in general (Ringler *et al*., 2011). The effects of climate change in our society cannot be overemphasized as this is evident in desert encroachment, increase in flooding as was majorly experienced in 2012 and now in 2022 and occurrence of drought. All of these have in no small measure affected man, his animals and crops. The menace of climate change has resulted to adverse effects on the lives of rural poor farmers, worsen food insecurity situation and the farmers socio-economic status (Gbetibouo, 2009).

Defang *et al.* (2017) stated that climate change goes a long way in posing a serious threat to ensuring food security especially in developing countries. Mustapha *et al.,* (2012) highlighted some specific relevant strategies that could be used to curb climate change and its effects. Such strategies include: climate information and forecasting, producing new traits and varieties, cropping adjustments, investment in water management and irrigation, production management and practices, insurance systems amidst other strategies. Singh and Grover (2013) acknowledged that disseminating these strategies is the core of the extension agents. They do this by providing farmers with information, new technologies and education on how to mitigate Greenhouse gas (GHGs) and cope with climate change so as to increase production and ameliorate living standards. Meanwhile, the awareness level of climate change amongst extension agents and farmers is low. No wonder Emaziye *et al.,* (2022) noted that most of the farmers of the region claimed from their believe that increase in climate change factors like increase in temperature, flooding, prevalence of diseases, sickness among others were punishment from gods. Suffice it to say that they have low level of perception of climate change. Since agriculture is a key economic sector of most low income or developing countries like Nigeria, it is therefore necessary to improve the resilience of the agricultural systems through effective adaptation production systems to adapt to climate change (Okpara *et al*., 2021). Against this background this study seeks to examine extension agent's perception and role to mitigating climate change effects on agricultural production through adaptive strategies in Kaduna State, Nigeria. The specific objectives of the study are to analyse the extension agents level of awareness of climate change, determine the role of extension agents in line with reducing the effects of climate change on agricultural production, identify the adaptive strategies adopted by farmers in alleviating the effect of climate change on farm production, and ascertain the perceived effects of climate change by extension agents on agricultural production.

The hypotheses of the study are; socio-economic characteristics of extension agents have no significant relationship with their perception of climate change on agricultural production. The second one is, there is no significant difference between extension agents with high and those with low level of awareness of climate change

Methodology

Study Area

The study was carried out in Kaduna State which is one of the oldest Northern States that was created on 27th May, 1967. It has 23 Local Government Areas and the capital seat is Kaduna city with a population estimate of 9,032,200 as at 2022 (NPC, 2022). A larger fraction of this population (80%) are farmers and that is what their livelihood depends on. The State is blessed with favourable climate which permits the growing of variety of crops like cotton, yam, maize, millet, ginger, rice, cassava, groundnut, beans, tobacco and guinea corn, as well as the rearing of variety of animals like sheep, goat and cattle. English language is the basic Lingual Franca of the people while the native language is Hausa (Okwuokenye and Petu-Ibikunle (2021). Kaduna State's coordinates are $10^0$20'N and $7^0$45'E, ranking 4th position amongst other States of the Federation in terms of land area (46,053Km^2). The report also stressed that the State belongs to the tropical region, having an average annual temperature of 25.2^{0}C and precipitation of 1211mm (Okwuokenye and Petu-Ibikunle (2021). The respondents of the study were extension agents who are serving in different LGAs of the Kaduna State.

Sampling Procedure and Sampling Size of the Study

The study adopted multi-stage random sampling technique in sampling the respondents used in the study. The first stage of the process has to do with the random selection of two out of three agricultural zones that make up the state. They were; Kaduna North and Kaduna South agricultural zones. The second stage involved the random selection of five local government areas per agricultural zone, thus making it ten LGAs that were used for the study. Local governments areas

randomly selected from Kaduna Central were: Chikun, Kaduna North, Kaduna South, Kajuru and Giwa LGAs. The ones randomly selected from Kaduna North includes Zaria, Sabon Gari, Makarfi, Kudan and Kubau LGAs. This was followed by the random selection of nine extension agents from each of the LGAs and this brought the number to ninety extension agents. They were met at their various offices in the various LGAs and administered with the question instrument (questionnaire). On a final note, the administered questionnaires retrieved were eighty-five (that is 94.44%)

Analytical Technique

Descriptive and inferential statistics were used to analyze the data of the study. Extension agents' level of awareness and those adaptive strategies adopted by the farmers in alleviating the effects of climate change were analyzed with percentages and means. On the other hand, 4-point Likert scale was used to identify the role of extension agents to farmers and as well as ascertain the extension agents perceived effects of climate change on agricultural production. The role of extension agents to farmers on amelioration of effects of climate change and perceived effects of climate change on agricultural production was analysed using the 4 – point Likert scale. The scale ranges from "strongly agree" (coded 4), "agree" (coded 3), "disagree" (2) and "strongly disagree" (coded 1). A weighted mean of 2.50 was determined as follows: {4+3+2+1} / 4 = 2.50. In where the role of extension agents is concerned, a weight of 2.50 and above is an indication that the extension agents agreed to have such as one of their roles to the farmers towards alleviating them off the effects of climate change. A mean weight of 2.50 and above also indicated that the respondents agreed to the perceived effects of climate change. On the contrary, a weight of less than 2.50 means that they did not agree to the perceived effects and challenges.

Binary logistics regression was used to analyze the socio-economic characteristics of extension agents, whether they have no significant relationship with their perception of climate change on agricultural production. Binary logistics involved determining whether each of a set of independent variables has a relationship to a dichotomous dependent variable (perception of climate change on agricultural production). It is expressed as:

$Y = a + b_1X_1 + b_2X_2 + b_3X_3,\ldots, + b_nX_n + e$

Y = Perception of climate change on agricultural production (measured as: high = 1; low = 0)

a = Constant

b_i [1 – n or 8] = Coefficients

$X_1 – X_7$ = Independent variables

e = Error term

The variable in the equation are defined below

The variables in the model were specified as;

Y = Perception of climate change on agricultural production (measured as: high = 1; low = 0)

X_1 = Gender (dummy: male = 1; female = 0)

X_2 = Age (years)

X_3 = Education qualification (Primary sch. = 1, Secondary sch. = 2, ND/NCE = 3, HND/B.Sc = 4, M.Sc. = 5 and Ph.D = 6)

X_4 = Marital status (single = 1, married = 2, divorced = 3, widow(er) = 4)

X_5 = Work experience (years)

X_6 = Household size (number of people staying and feeding together)

X_7 = Religious affiliation (Christianity = 1; Muslim = 2; Traditionalist = 3)

X_8 = Monthly income (₦)

Binomial test was used to determine if there was any significant difference between the proportion of extension agents with high and those with low level of awareness of climate change. The formula for binomial distribution is given as follows:

$b(x;n,p) = {}_nC_x * p^x * (1-p)^{n-x}$

Where b = binomial probability

x = total number of successes (satisfied or not satisfied)

p = probability of success on an individual trial
n = number of trials

In making a decision, the possible values of the test statistics are divided into two ranges. The critical region of the sample distribution is the area of the sampling distribution of a statistic that will lead to the rejection or acceptance of the hypothesis.

Results and Discussion

Extension agents' level of awareness to climate change

The awareness level of the extension agents to climate change is shown in Table 1. The result showed that majority (45.88%) of the extension agents had low level of awareness of climate change. About 25.88%, 7.06%, 16.47% and 4.71% of them respectively indicated average, high, very high and poor level of awareness of climate change. The result implies that the level of awareness is low. The respondents adduced climate change to nature. The low awareness level of climate change recorded confirmed the report of Emaziye, *et al.* (2022).

Table 1: Extension agents' level of awareness to climate change

Level of awareness	Frequency	Percentage
Very high	6	7.06
High	14	16.47
Average	22	25.88
Low	39	45.88
Poor	4	4.71

Source: Field survey, 2022

Role of Extension Agents to Farmers on How to Cope With the Effects of Climate Change on Agricultural Production

Table 2 shows the role of extension agents to farmers in line with reducing the effects of climate change on agricultural production. The roles are presented in the order of sizes of their means. The roles were; capacity development of the farmers through training and re-training to acquire skills on how to adapt to climate change (mean = 3.07), providing information to farmers on new varieties of crops and breeds of animals that can adapt to climate change (mean = 3.03), dissemination of innovations on best practices in climate change management (mean = 2.96) and facilitating and implementing policies and programs by making extension system to link farmers and other people in rural communities directly with private and public institutions that disseminate adaptation technologies and funding programs to cope with climate change (mean = 2.88) and providing feedbacks to governments and research centres with various causes of climate change and its effects (mean 2.82). The other roles of extension agents to alleviating effects of climate change were; providing information to government on the local knowledge and practices of the rural people (mean = 2.80), use of farmer-to-farmer extension strategy to promote awareness to farmers and adoption of best practices on how to manage climate change and its effects (mean = 2.79), use of demonstration methods in teaching farmers on how to apply measures to adapt to the effects of climate change (mean = 2.70), extension agents helping to organizing seminars, workshops, and field days to sensitize farmers and the public on how to manage climate change and its effects (mean = 2.67), the spread of information through information communication technologies (ICTs) (mean = 2.60) and use of young farmers club (YFC) and farmer field schools (FFS) to create more awareness to farmers on the measures used to adapt to the effects of climate change (mean = 2.58)

Table 2: Role of Extension Agents to Farmers on how to cope with the Effects of Climate Change

Role of Extension agents to farmers	Mean	Standard Dev.
- Capacity development of the farmers through training and re-training of farmers to acquire skills on how to adapt to climate change	3.07*	0.61
- Providing information to farmers on new varieties of crops and breeds of animals that can adapt to climate change	3.03*	0.55
- Dissemination of innovations on best practices in climate change management.	2.96*	0.54
- Facilitating and implementing policies & programs by making extension system to link farmers and other people in rural communities directly with private and public institutions that disseminate adaptation technologies, and funding programs to cope with climate change.	2.88*	0.71
- Providing feedbacks to governments and research centres with various causes of climate change and its effects	2.82*	0.73
- Providing information to government on the local knowledge and practices of the rural people	2.80*	0.61
- Use of farmer-to-farmer extension strategy to promote awareness to farmers on best practices on how to manage climate change.	2.79*	0.50
- Use of demonstration methods in teaching farmers on how to apply measures to adapt to the effects of climate change	2.70*	0.59
- Extension agents helping to organizing seminars and workshops, and field days to sensitize farmers on climate change	2.67*	0.50
- The spread of information through information communication technologies (ICTs) such as the internet, radio, television, newspapers, to create awareness on climate change.	2.60*	0.49
- Use of young farmers club (YFC) and farmer field schools (FFS) to create more awareness to farmers on the measures used to adapt to the effects of climate change.	2.58*	0.66
- Denying those farmers who indulge in poor agricultural practices like bush burning that contribute to climate change any access to extension agents and their services	2.46	0.53
- Implementing punitive measures through the use of law enforcement agents against persons that deliberately indulge in practices that contribute to climate change such as bush burning.	2.34	0.51

Agreed (mean ≥ 2.50);
Source: Field survey, 2022

This result corroborates with the claims of Ozor and Nnaji (2011) which expressed that provision of information through the use of appropriate information communication technologies are capable of assisting farmers in overcoming the effects of climate change. The result by implication shows that the roles of extension agents in managing climate change and its effects are enormous and cannot be over emphasized.

Adaptive Strategies Adopted By Farmers in Alleviating the Effects of Climate Change

The adaptive strategies adopted by the farmers to mitigate against the effects of climate change are shown in Table 3. The strategies that are adopted by 50% and more respondents are noted as strategies that are popularly used by the respondents to alleviate the effects of climate change. The result revealed that seventeen of the presented strategies were popularly used to alleviate the effects of climate change on farm production. The strategies included; planting new and improved crop varieties and animal species that are resistant to climate change (95.29%), apply modern production management and practices (91.76%), use of climate information and forecasting (84.71%), farmers

engagement in insurance schemes (71.76%) and apply water management and irrigation systems (77.65%). Other coping strategies were cropping adjustments systems (83.53%), diversification in crop enterprise/planting different types of crops (90.59%), changing in planting dates of crops (96.47%), changing in harvesting dates of crops (90.59%) and changes in the timing of land preparation activities (97.64%). In addition, application of mixed farming (84.71%), practicing shifting cultivation system (69.41%), construction of shelter for animals and human using palms, grasses and other non-conductors of heat (74.12%), adoption of zero or minimum tillage system (94.12%), contour cropping across hill/slopes (85.88%), expansion of cultivated area (64.71%) and uprooting and discarding infected plants and culling of infected animals (81.18%) were also presented as coping strategies to alleviate the climate change on agricultural production.

The result on the adaptive agreed with that of Ozor and Nnaji (2011) as the authors stated that most of the above identified strategies were agreed as strategies that could help farmers to cope with climate change and its effects. However, adoption of adaptive strategies would go a long way in reducing farm losses and improving farm productivity and income. This assertion concurred with that of Iheke and Agodike (2016) who reported that adoption of climate change mitigating strategies is key to coping and building resilience against climate change and its effects, therefore increasing agricultural production, and lifting rural smallholder farmers out of poverty and food insecurity.

Table 3: Adaptive Strategies Adopted By Farmers in Alleviating the Effects of Climate Change

Adaptive Strategies	Frequency	Percentage
- Planting new and improved crops varieties and animal species that are resistant to climate change	81	95.29*
- Apply modern production management and practices	78	91.76*
- Use of climate information and forecasting	72	84.71*
- Farmers engage in insurance scheme	61	71.76*
- Apply water management and irrigation systems	66	77.65*
- Cropping adjustments systems	71	83.53*
- Diversification in crop enterprise/planting different types of crops	77	90.59*
- Changes in planting dates of crops	82	96.47*
- Changes in harvesting dates of crops	82	90.59*
- Changes in the timing of land preparation activities	83	97.64*
- Changes in planting depth of seeds and seedlings.	34	40.00
- Application of mixed farming	72	84.71*
- Practicing shifting cultivation system	59	69.41*
- Construction of shelter for animals and human using palms, grasses and other non-conductors of heat	63	74.12*
- Afforestation/ reforestation initiatives	22	25.88
- Processing of crops to reduce post-harvest losses and enhance shelf life of crops	11	12.94
- Increased range land.	17	20.00
- Adoption of zero or minimum tillage system	80	94.12*
- Contour cropping across hill / slopes	73	85.88*
- Expansion of cultivated areas.	55	64.71*
- Uprooting and discarding infected plants and culling of infected animals	69	81.18*
- Decrease in stocking rate of animals.	41	48.24
- Lengthened fallow.	31	36.47
- Laws against deforestation activities	38	44.71
- Abandonment of crop land or destruction of infected Animals	36	42.35
- Changing from production to marketing of agricultural products	26	30.59
- Water and soil moisture conservation practices	21	24.71

Source: Field survey, 2022.

****Strategies that are popularly used by the respondents***

Perceived Effects of Climate Change on Agricultural Production

The perceived effects of climate change on agricultural production are shown in Table 4. The perceived effects are presented according to the size of their means and those with mean magnitude of ≥ 2.50 are considered as perceived effects. Results revealed that incidence of pest and diseases (mean = 3.68), decrease in yields of crops and animals (mean = 3.66), premature ripening of crops (mean = 3.42), high intensity of rainfall (mean = 3.28) and increase in growth of weeds (mean = 3.10). Other perceived effects were post-harvest losses (mean = 2.99), destruction of field crop by rain and wind (mean = 2.79), increase poverty level among farmers (mean = 2.73), soil erosion (mean = 2.70) and increase in flood occurrence (mean = 2.67). Furthermore, increase in heat due to high temperature (mean = 2.62), unavailability of water for crops and animals consumption (mean = 2.60), drying of rivers, lakes and other water bodies (mean = 2.56), increase in drought

occurrence (mean = 2.56), decrease in soil fertility (mean = 2.53), health related issues on the farmers (mean = 2.51) and increase in cost pf production (mean = 2.50) were perceived as effects of climate change on agricultural production.

The perceived effects are in one way or the other related to one another. The resultant effect of the above incidence of climate change is the increase in cost of production of agricultural products while lowering the farmers farm income and increasing their poverty status. This assertion is in line with that of Iheke and Agodike, (2016) who claimed that if climate change mitigating strategies are not carried out, agricultural production will decrease and farmers poverty level will worsen

Table 4: Perceived Effects of Climate Change on Agricultural Production

Perceived effects of climate change on agricultural production	Mean	Standard Deviation
- Incidence of pest and diseases	3.68*	0.57
- Decrease in yields of crops and animals	3.66*	0.60
- Premature ripening of crops	3.42*	0.61
- High intensity of rainfall	3.28*	0.55
- Increase growth of weeds	3.10*	0.54
- Post-harvest losses	2.99*	0.61
- Destruction of field crop by rain and winds	2.79*	0.63
- Increases poverty level among farmers	2.73*	0.61
- Soil erosion	2.70*	0.50
- Increase in flood occurrence	2.67*	0.59
- Increase in heat due to high temperature	2.62*	0.50
- Unavailability of water for crops and animal consumption	2.60*	0.49
- Drying of rivers, lakes and other water bodies	2.56*	0.66
- Increase in drought occurrence	2.56*	0.53
- Decrease in soil fertility	2.53*	0.51
- Health related issues on the farmers	2.51*	0.53
- Increases cost of crop production	250*	0.41
- Fertilizer use increases the negative effect of climate change	2.34	0.41
- Poor quality of produce	2.26	0.49
- Increase in soil fertility	2.21	0.31
- Low intensity of sunlight	2.12	0.57
- Low rainfall	2.11	0.60

Agreed (mean ≥ 2.50);
Source: Field survey, 2022

Relationship between Socio-Economic Characteristics of Extension Agents and Their Perception of Climate Change on Agricultural Production

Binary Logistics regression was used to analyze the relationship between socio-economic characteristics of extension agents and their perception of climate change on agricultural production (see Table 5). The variables in the model jointly accounted for about 71.3% variation of climate change on agricultural production. The model was considered appropriate for the analysis with the F-ratio (9.050) being significant at 5% level (Critical F-value = 3.840). Out of eight of the socio-economic variables, five of them were significant to extension agents' perception of climate change on agricultural production. The extension agents' socio-economic characteristics that were significant include; aged, educational level, marital status, household size and work experience.

Age of the respondents had a b-coefficient of 0.171, SE of 0.008 and t-value of 2.936. The relationship was positively significant at 1% level to extension agent's perception of climate

change on agricultural production. What this implies is that extension agents who are more in age or older are likely to have higher perception of climate change on agricultural production. Older age simply counts on more experience of the extension agents and which knowledge they can use to know how climate change affects agricultural production. This assertion is in line with Olorunfemi *et al.* (2019) who concluded that the more extension agents are in age, the more they are positively influenced in their ability to effectively perform their duty in line with furnishing the farmers with mitigating strategies to alleviate the effect of climate change on agricultural production. The educational qualification of the extension agents was positively significant at 1% level. The b-coefficient was 1.879 with SE of 0.348 while the t-value was 2.547. The result implies that higher education level of the extension agents will increase their perception of climate change on agricultural production. This result is in line with that of Olorunfemi *et al.* (2019) who affirmed that positive relationship implies higher educational level will increase the training and exposure of the extension agents to various concepts and innovation that are related to climate change.

Marital status (b = 0.387; SE = 0.115 and t-value = 4.76) of the respondents was positively significant at 1% level. The implication of the result is that since majority (78.82%) of the extension agents were married, it therefore means that having more married extension agents amongst the extension service workers would go a long way in increasing their perception of climate change on agricultural production. This attribute is in line with the responsibilities endowed in them as married persons and the interest as well as attention given to dissemination of reliable agricultural information that would help curb the menace of climate change on agricultural production. The b-coefficient, SE and t-value for work experience was 1.883, 0.041 and 3.963 respectively. The relationship was positively significant at 1% level. The positive relationship implies that the more experience (in years) extension agents acquire in the job of extension service delivery, the more perception about climate change they are likely to have on agricultural production. The result aligns with findings of Bahua *et al.* (2013) who stated that an increase in work experience of extension agents improves their job performance in getting acquainted and diffusing innovation to farmers. Household size of the extension agents had a positive relationship with their perception of climate change on agricultural production. The coefficient was 3.948, with SE of 1.124 and t-value of 3.998. The relationship was positive and significant at 1% level. The result implies that having more household size will lead to them having higher perception of climate change on agricultural production. This result aligns with the findings of Olorunfemi *et al*. (2019) which expressed that larger household size is expected to aid the frequency of contact between extension agents and farmers. Such scenario will lead to making more information available to the farmer which would be used to check the effects of climate change in agricultural production.

Table 5: Relationship between Socio-Economic Characteristics of Extension Agents and Their Perception of Climate Change on Agricultural Production

Variables	Coefficient (b)	Standard Error (SE)	t-value	Significant level
Constant	66.755	5.152	3.318	0.000
Gender	1.550	1.501	0.134	0.162
Age	0.171**	0.008	2.936	0.004
Educational status	1.879**	0.348	2.547	0.012
Marital status	0.387**	0.115	4.762	0.000
Religious affiliation	1.265	0.817	1.153	0.250
Household size	3.948**	1.124	3.998	0.000
Work experience	1.883**	0.041	3.963	0.000
Monthly income	0.076	0.031	1.079	0.282

***Significant at 1 % level;* **-2log Likelihood = 113.632; Nagelkerke R^2 = 0.713**
Fdf; = 7; p < 0.05; Fcal = 9.050; Ftab = 3.840

Test of Difference in Extension Agents That Have High and Those with Low Level of Awareness of Climate Change

The relationship of extension agents that have high and those that have low level of awareness of climate change is shown in Table 6.

Table 6: Test of Difference in Extension Agents That Have High and Those with Low Level of Awareness of Climate Change

Level of perception	Frequency	Proportions	Probability level
Low awareness	63	74.12 (0.74%)	0.001
High awareness	22	22.88 (0.25%)	
Total	85	100.00 (1.00%)	

Source: Field survey, 2019

The relationship was analyzed with binomial test. The results revealed that a larger proportion (74.12%) of the respondents had low level of awareness of climate change. On the other hand, few (25.88%) of them had high level of awareness of climate change.

Statistically, the result was significant at 1% level of probability. For this reason, there is no significant difference between extension agents with high and those with low level of awareness of climate change. The result thus suggested that the extension agents with low level of awareness of climate change were more in number over those who had high level of awareness of climate change. This assertion was deduced from the low proportion of respondents (extension agents) that fell under this category. By implication, the extension agents servicing the farmers with extension packages or information perhaps did not see any relationship between changes in climatic factors and agricultural production. The respondents however ascribed changes in climatic factors to nature. The low awareness level of climate change as reported by this study confirms the findings of Emaziye, *et al.* (2022). It was speculated that agents of climate change (erosion, excessive heat, too much rains, drought, etc) were simply punishment from their gods and nothing more.

Conclusion and Recommendations

The study was carried out to ascertain the extension agent's perception and role to mitigating climate change effects on agricultural production through adaptive strategies in Kaduna State, Nigeria. On a specific note, the study analysed the extension agents' level of awareness of climate change and as well determined the role of extension agents on how to reduce effects of climate change through adaptive strategies on agricultural production. The result revealed that despite the negative impacts of climate change on crops and animals, most of the extension agents still claimed not to be aware of climate change and its effects, and it is on this ground that the farmers have not taken measures to adapt to climate change strategies. Against this background, the extension agents advanced roles like capacity development of the farmers, provision of reliable information on improved crops and animals and dissemination of innovations on practices that could help reduce the effects. Some of the adaptive strategies that could help to mitigate the menace of climate change are the planting of new, resistant and improved crop varieties and animal species, apply modern production management practices and the use of farm insurance scheme.

Based on findings of this study, it was recommended that: extension agents should do well to drive down to the farmers the necessary adaptive strategies that would help to curb the effects of climate change. There should be increased campaign on the need to sensitize the extension agents and farmers on climate change and its effects. Doing this will help to increase the adaptation of climate change strategies and overcome the declining output of agricultural productions. Government, through their necessary institutions should make improved and resistant crops and animals available (at affordable prices) for the farmers to adopt in other to be alleviated of climate change effects, and; There is a need to ensure that the personnel's used as extension agents have reasonable

level of education attainment. This has become necessary because of the positive relationship education has with their perception about climate change.

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