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Climate Change

The analysis of climate smart agricultural indices on groundnut farming household enterprise in Katsina State, Nigeria

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The current level of poverty in Nigeria is disturbing and climate change impends food security and increases poverty indirectly and directly on individuals or households. Farming households are changing agricultural practices as a result of global observation of climatic and environmental changes. This research work recognised a link which exists between climate change, climate smart agricultural practices (CSAP) and poverty status of farming households in North West Nigeria. The study examined the factors influencing indicators of climate smart agricultural practices on groundnut farming household enterprises in the study area. This is with a view to establishing the consequences of climate variation and its influence on poverty status among rural farmers in North West Nigeria. The multi-stage, sampling techniques was used to select three hundred (300) respondents who provided the relevant primary data for this study through a set of pre-tested structured questionnaires. The data were analyzed with descriptive statistics, Principal Component Analysis (PCA), Ordinary Least Square (OLS) regression model. The regression analysis result showed that age, education and farm size were significant at 1, 5 and 10% respectively. The study recommended that Governmental and farmers' organisations can fashion out a favourable training workshop to inspire the low-users of CSA to improve on their performance. Also, the policies on informal education should be enhanced and enforced in the curriculum to meet the CSAP challenges. Extension delivery system approach should be upgraded to meet the present information age.

INTRODUCTION

Groundnut *Arachishypogea* belong to the family leguminosea. It originated from Latin America and Portuguese introduce it into West Africa from Brazil in the 16th Century (Hamidu *et al.*, 2006).

Nigeria is the largest groundnut producing country in West Africa accounting for 51% of the production in the region. The country produces 10% and 39% of the World and Africa's total production respectively. Prior to 1980s, groundnut production declined significantly due to incidence of drought (Ndjeunga and Ibro, 2010).

Presently, the earth surface is gradually warming up daily and the rate at which it heats up keeps on increasing both daily and yearly. However, this is an undisputable report of the Inter-Governmental Panel on Climate Change (IPCC) 4th assessment report in 2007, which proposed whole enquiry into how the issue of climate change is impacting on natural, human and physical structures. Besides, there is a growing concern about the possible significances of climate change on poverty status, livelihood projections, economics development, as well as overall human development. It has also been noted that climate change leaves many people vulnerable to poverty, and it was projected that about half of the world's populace, as well as most of those who reside in the industrious urban areas located by the region of coastal delta are susceptible to climate tragedies (IFRC, 2000). However, most of the affected communities are mainly found where there is concentrated number of the underprivileged families, majorly in Sub-Saharan Africa (SSA). As a result, the impacts of climate changes such as desertification, landslides, droughts and flooding, will not only decrease farm output such as the groundnut enterprises for many farmers, but will also expose them to poverty in due course. Therefore, it is vital to design policies as well as impose practices that will adapt to the current observed changes in the weather climatic environment. Nigeria produces majority of the total groundnut production in West Africa (Abalu and Etuk, 1998; Hamidu *et al.*, 2006). Groundnut contains 25% protein and more than 48% oil (Echekwu and Emeka, 2005). Groundnut flour is used as an ingredient in soup confectionaries and pudding. Groundnut cake is often deep fried or dried to make a snack caked kuli-kuli (Hamidu *et al*., 2006).

The use of groundnut plant makes it an excellent cash crop for domestic markets as well as for foreign trade in several developing and developed countries (FAO, 2006). Groundnut which is essentially a tropical plant requires a long and warm growing season. The favourable climate for groundnut is a well distributed rainfall of at least 500mm during the crop growing season, and with abundance of sunshine and relatively warm temperature. Temperature in the range of 25° to 30°C is optimum for plant development; a rainfall of 500 to 1000mm will allow commercial production (Weiss *et al*., 2000).

Consequentially, emphases are now placed on the implementation of CSAP in order to meet the subsequent daily population increase. Meanwhile, CSA is defined as agricultural practices that sustainably increase agricultural productivity including groundnut enterprises, income, adapt and build resilience to climate change, eliminate or

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reduce greenhouse gas emission or adapt to changing climate, which heightens the accomplishment of national food security and developmental goals which include poverty reduction, (FAO 2010). However, agriculture is measured to be climate smart when it achieves three key objectives which are: building resilience to climate alteration, reduction of greenhouse gas emission and sustainable increase in agricultural productivity (Fanen and Adekola, 2014). For instance, Mnkeni and Mutengwa, (2014) noted that to increase food production CSA stimulates renovation of agricultural systems and agricultural policies in order to improve food security and warrant affordable food with low input-cost; hence there is a reduction in poverty while conserving the biodiversity and guaranteeing resilience to a changing climatic environment. Additionally, existing data revealed that Nigeria suffers from numerous environmental problems which have been directly associated with the ongoing climate change (Adefolalu, 2007). The southern part of Nigeria, mostly known for high rainfall, is currently threatened with abnormality in rainfall patterns, while the Savannah zone is slowly increasing temperatures. In the same vein, the northern part also faces the hazard of desert encroachment at a very high rate annually, brought by a serious decline in the volume of surface water, wildlife resources and vegetation biomass (Obioha, 2008). Nevertheless, climate change adaptation, particularly at the rural areas, is vital because the impacts are best felt and understood at the local level; climate change influences are also experienced at the rural areas where the adaptive capability and susceptibility are very much felt (Anita H Philip *et al*. 2018). Consequently, in view of the foregoing, this study seeks to establish the factors influencing indicators of climate smart agricultural practices on groundnut farming household enterprises in the study area. The groundnut products such as the oil are used for cooking, as salad oil, for canning sardines, and margarine manufacturing (Sharma and Caralli, 2004). The residue after oil extraction is a source of protein for animal feed. In traditional oil extraction method, this residue is fried into a local delicacy known as groundnut cake or 'kulikuli' in Hausa. Similarly, Groundnut haulms also provide excellent hay for livestock (Taru *et al.*, 2010). It is also used as animal feed (oil pressing, seed, green materials and straw) and industrial raw material (oil and cakes and fertilizer). Almost each part of the crop is used in some way (Abdel, 2007). These multiple uses of groundnuts plant make it important for both food and cash-crop for the available domestic, or worldwide external markets in several developing, and developed countries. The shells are used for fuel by some local oil factories or they are sometimes spread on the field as a soil amendment. They could also be used as bulk in livestock rations or in making chipboard for use in joinery (Mukhtar, 2009).

Problem statement

Groundnut improves soil fertility through nitrogen fixation, thereby increasing the productivity of other crops when used in rotation or in a cereal cropping system. The poor productivity of groundnut cultivation in African countries may be attributed to a combination of factors such as unreliable rains, mostly no irrigated nature of cultivation, traditional small-scale farming with little mechanization, outbreaks of pests and diseases, use of low-yielding varieties, poor adoption of agronomic practices such as climate smart agricultural practices and limited extension services (Ndjeunga and Ibro, 2010).

Nigeria faces diverse environmental problems which are directly associated with recent climate change (Ikhile, 2007; Philip H John *et al*. 2018). Obioha, (2008) confirmed that, northern Nigeria generally, is under constant attacks and faces hazard of desertification, which has been prompted by decrease in the quantity of rainfall. Empirical study of the climate change in the North-Western part of Nigeria within 1915-2008 revealed that the rainfall of that zone has fluctuated significantly (Ekpoh and Nsah, 2010). In Africa, CSA offers multiple benefits in consonant with attainment of the goals to sustainably increase agricultural productivity which include groundnut enterprise, increase smallholder farmers' resilience to the effects of climate change and reduce GHG emissions from agricultural activities (Naess, 2011). Local processing of groundnut and other sources of oil have still not met the domestic demand for vegetable oil. This is shown in the importation of vegetable oil to supplement local production, with its attendant drain on foreign exchange (Ojowu, 2004). Consequent upon the above, the challenge of achieving this target was on the groundnut production and processing industry. Hence this study focused on critical areas which are the climate smart agricultural practices on groundnut farming household enterprises in the study area.

Fanen and Adekola, (2014) opined that, although, many nations are projected to embrace CSA, its demonstration in an African perspective is not yet so, neither has its sustainability been evaluated. However, subsequent global warming and changes in climate are impending danger to food security, with a consequential increase in poverty levels in numerous developing nations, including Nigeria due to high dependence of agricultural systems on some climatic parameters (Bello *et al*., 2012). Additionally, rising problem of climate change effects is a worldwide issue, and the developing nations are particularly the most vulnerable, because the African nations' agricultural production system are mainly rainfed and basically relying on the whims of weather, (Onyenechere, 2010; David Chikodzi *et al*. 2018). In the northern part of Nigeria, the number of rainy days has dropped by 53% which brings about irregular rainfall arrangement with subsequent increase in temperature in Katsina States. The impact of this, drop has resulted into a rise in desertification, drought and evapo-transpiration which patently can result in the reduction of moisture content or the complete dryness of streams, and particularly with continuous annihilation of biodiversity and forest (Adefolalu, 2007). Drought and seasonal rainfall have regularly become perpetual features of northern part of Nigeria. The dry season is commonly severe, and hence it is very essential for groundnut farmers to engage in soil moisture preservation agricultural practices in order to ease the destructive effect of climate change at this period.The North West region of Nigeria remains an agricultural hub for the nation with a huge proportion of its population in the agricultural sector (Olapojo, 2012). Nevertheless, it is the poorest zone in Nigeria according to National Bureau of Statistic (NBS, 2013). In 2010, conventional CSAP were introduced to farmers in North-West part of Nigeria. Through a programme called International Institute for Environment and Development (IIED) by the help of Katsina State Agricultural and Rural Development Authority (KTARDA). The CSAP that were introduced by the agency are: use of organic manure, agro-forestry and conservation agriculture, the use of improved hybrid varieties of crops and livestock, integrated crop/livestock management as well as irrigation for small-holder farmers. Obviously, this was in response to low agricultural productivity with low agricultural output and high incidence of poverty among farmers in North-West Nigeria. In point of fact, presently, desertification and drought have affected several portions of the north, with a resultant yearly extensive decrease in agricultural yields from one locality to another (Oyekale, 2009).

Before oil boom era of the 1970 – 1980 groundnut had play a very significant role in the Nigeria's agro-economic development of the 1960's. Despite its importance, there are numerous problems confronting groundnut production such as inadequate improved seeds,

pest and diseases and changing weather pattern characterize by the repeated drought as a result of climate change via ozone layer depletion. Groundnut producers as well as marketers encounter a lot of problem in relation to their accomplishments, the problems include lack of technical Know-how in the production activities which include using climate smart agriculture, marketing and processing. Generally this include lack of adequate storage facilities, pests and diseases infestation and drought (Akonbundu, 1996)

Furthermore, Thornton *et al*., (2006) predicted that by the year 2050, in the sub-tropics, crop yields may decrease by 10 – 20% as a result of global warming but there are some places where the crop yield and livestock output damages may be more severe. Global warming causes unpredictable and great weather events that impact and gradually affecting crop growth, droughts, floods, availability of soil water and sea level rises with prevalent diseases (Zoellick and Robert, 2009). Then, the restraints set by climate change on agricultural activities in this region range from prominent variation in precipitation which may be shorter periods of rainfall or irregular rains, (which limits crop/livestock production) to repeated droughts. Moreover, the droughts unveil such features as fictional onset of the rains, late onset of the rains, prominent halts through the rainy season, and early termination of the rains, leading to severe modifications in the pattern of seasonal rainfall dissemination (Ayanwale, 2007). The report of Tadross *et al.,* (2009) indicated that influence of climate change on crop yield is not restricted to total rainfall effects alone, the intra-seasonal shocks are also very significant because intra-seasonal arid spells may be more destructive to growth than short entire rainfall. Very high extreme temperature through the growing season is also considerably unfavourable to crop yields and livestock output (Thornton and Cramer, 2012). Such sequential deviation is anticipated to rise in many parts of Africa nations under most climatic change situations (Boko *et al*., 2007). According to the submission made by United Nation Development Programme, high rate of poverty makes majority of the population susceptible to climate change and compromises their adaptation capacity (UNDP, 2011). However, this poverty status is worse in the rural communities where over 70% of the population dwelled and earn their living via agricultural activities which include both the groundnut and livestock enterprises order than in the urban cities. Moreover, greater than 86.5% of the rural populace is involved in farming activities (NBS, 2005). Consequently, this consistently defines agriculture as an important sector capable of affecting majority of Nigerians in various ways. Importantly, the persistence of poverty and hunger in Nigeria, to a large degree must then be attributed to the failure of the agricultural sector to fully impact positively on the largest and most populated nation in Africa.

These problems affect groundnut production in Katsina State. The demand of groundnut and groundnut products is rapidly growing by the day to meet up with vegetable oil required which is used in the production of salad oil, Margarine and many other fat substitutes and protein. It is hope that, this study will provide information that will be useful to prospective producers and stakeholder in the study area and the nation in general. The study therefore examined the factors influencing indicators of climate smart agricultural practices on groundnut farming household enterprises in Katsina State, Nigeria.

Objective

Determine factors influencing indicators of climate smart agricultural practices on groundnut farming household enterprises in the study area.

Hypothesis

The Null hypotheses of the study are stated below:

H_0: Farmers' socio-economic characteristics (age and education) do not significantly influence indicators of climate smart agricultural practices on groundnut farming household enterprise.

METHODOLOGY

The study area is Katsina State which comprises of thirty four (34) Local Government areas. The agricultural sector forms the basis of the overall development thrust of the zone. The region is described as a relatively hot climate with seasonal rainfall and a marked dry season (Draper and Maureen 2009). The study was carried out in Katsina State. Katsina State is located in the North-Western region of Nigeria. The State, covers an area of 23,938 sq. km and is located between latitudes 11Â°08'N and 13Â°22'N and longitudes 6Â°52'E and 9Â°20'E. The State is bounded by Niger Republic to the north, by Jigawa and Kano States to the east, by Kaduna State to the South and by Zamfara State to the West. Katsina State has rich cultural values with annual rainfall ranging from 800m to 1000mm. Katsina has 3 agricultural zones. The zones and the LGAs covered included:

a) Ajiwa Zone: comprises of Kaita, Jibia, Batagarawa, Rimi, Charanchi, Bindawa, Mani, Daura, Maiadua, Sandamu, Baure, Zango, Mashi, Dutsi and Katsina.
b) Funtua zone: comprises of Funtua, Kankara, Faskari, Bakori, Dandume, Malumfashi, Kafur, Danja and Musawaand Matazu.
c) Dutsin ma zone: comprises of Dutsin ma, Danmusa, Kurfi, Safana, Kankia, Ingawa, Kusada and Batsari.

The climate makes the farmers to cultivate a very widespread of crops such as cereal, legumes and vegetables. The farmers also reared livestock such as cattle, goats, sheep, and poultry farm like chicken, turkey, pigeon and ostriches etc are produced and the livestock are reared extensively.

Sample size

A multi-stage sampling procedure was employed for the collection of data from the rural farming households. The first stage involved a purposive selection of Katsina States due to high prevalence rate of poverty and high quantities of groundnut enterprises in the north-west Nigeria (NBS, 2013). The second stages involved a random selection of three (2) Local Government Areas from each of the three agricultural zones in Katsina State to give a total of six (6) LGA's. Thirdly, the random selection of ten (10) communities from each of the LGA's to give rise to sixty communities. And finally the random selection of five (5) farming household from each community was to give a total of three hundred (300) respondents.

Data analysis

The objective was ascertained with the help of multiple regression techniques using the OLS model estimation methods. Additionally, some definite assumptions must be verified to ensure reliability and robustness of estimated parameters. However, assumptions that pertain more to cross sectional analysis like this one, include multicollinearity and heteroscedasticity. Multicollinearity was used to examine the objective with the help of Variance Inflation Factor (VIF), while the heteroscedasticity was automatically catered for by the Stata software using the robust option when regressing the model analysis. To determine the factors influencing indicators of CSAP on groundnut farming household enterprises, the socioeconomic characteristics are regressed against composite dependent variables on the use of climate

smart agricultural techniques in groundnut enterprises. The PCA was used to compute the composite dependent variables that will be estimated with a multiple regression model. The PCA was used to generate the composite variable for the use of CSA for the groundnut enterprise.

The PCA as specified by Ifelunini *et al*., (2013) is presented thus: Given variables (Xs represent the various factors used to develop the groundnut enterprise) $X_1,\ldots, Xp$ measured in 'n' farmers, while $Z_1,\ldots, Zp$ are the principal components which are uncorrelated linear combinations of the original variable, $X_1,\ldots, Xp$, given as:

$$Z_1 = \alpha_{11}X_1 + \alpha_{12}X_2 +\ldots+ \alpha_{1p}X_p \ldots\ldots\ldots\ldots \text{(i)}$$

$$Z_2 = \alpha_{21}X_1 + \alpha_{22}X_2 +\ldots+ \alpha_{2p}X_p$$

. . . .

. . . .

$$Zp = \alpha_{p1}X_1 + \alpha_{p2}X_2 +\ldots+ \alpha_{pp}X_{pz}$$

The matrix of equations can be expressed as z = Ax, where z = ($Z_1\ldots$ Zp), x = ($X_1\ldots$ Xp) and 'A' is the matrix of coefficients. The coefficients of the first PCA, $\alpha_{11}\ldots$ α1p, are chosen in such a way that the variance of Z_1 is maximised subject to the constraint $\alpha 2_{11}\ldots\ \alpha_{21}p = 1$. The groundnut composite variables are derived using the Principal Component Analysis (PCA) that are regressed against the socio-economic characteristics. The multiple regression model analysis is specified thus:

$$Y_{ij} = \beta_0 + \sum_{i=1}^{20} \beta_{ij}X_{ij} + \mathcal{E}_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Where Y_{ij} represents the dependent variables (the two composite CSA variables for the groundnut enterprise as dependent model), β_0 represents the intercept, β_i the coefficients of the independent variables, X_i the independent variables listed above and $\mathcal{E}_i$the stochastic or error term. The analyses were carried out for groundnut enterprises separately. Y_{ij} is the Composite variable for crop CSA indices, Xij are the independent variables andε_{ij} is the stochastic error term.

EMPIRICAL RESULTS AND DISCUSSION

This section advances the results of the analysis on the factors influencing the use of CSAP on crop enterprises and the crops which include maize, sorghum, millet and groundnut enterprises, using the PCA and the OLS multiple regression analysis model. The PCA was used to generate the composite variable for the use of CSA for each of the enterprises, namely: maize, sorghum, millet and groundnut. Thereafter, these composite variables were organised as dependent variable in order to analyse their correlates. The composite indices were constructed from six CSAP, which are the use of organic manure, agro-forestry, and conservation agriculture, use of improved hybrids, integrated crop/livestock management and irrigation.

Factors Influencing Climate Smart Agricultural Practice for Groundnut Enterprises

The Ordinary Least Square (OLS) Regression result of groundnut enterprise in Table (ii) signified that the F-statistics (0.0320) of the regression model was significant ($p<0.05$), an affirmation that the model was fitting. The multiple coefficient of determination in R-Square of 0.1111 revealed that 11.11% of the variation in groundnut enterprise can be explained by the explanatory variables included in the model. The results also depicted that age was significant ($p<0.01$). This implied that a unit increase in age of the farmers will lead to a corresponding increase in the indices of CSA for groundnut farmers by 0.0372. This result maintained a match with that of Zalkuwi *et al*., (2013). Their study confirmed that the older farmers were more prompt in their perception and response to risk management than younger farmers.

Additionally, the examination demonstrated that education was significant at $p<0.05$. Evenly, it pointed to the fact that those who had informal education (Arabic education) had their indices of CSAP in groundnut enterprise being significantly lower by 0.2102 when compared to their counterparts with formal education. For instance, Anselm and Taofeeq, (2010) confirmed that groundnut farmers lack requisite education that can make them productive and effect positive changes in their productive activities. Again, farm size was significant ($p<0.10$), meaning, that a unit increase in farm size will lead to a corresponding increase in the indices of CSAP for groundnut farmers by 0.0487. The result maintained a par with the work of Ani, (2013) who hypothesised that increase in farm size coupled with ecological flexibility, will guarantee productivity in groundnut farming.

Hypotheses statement

The study employs the hypotheses which its objective can be statistically measured:

The null and alternative hypothesis for the objective is specified thus:

H_0: Farmers socio-economic characteristics (age and education) do not significantly influence indicators of CSAP on groundnut farming household enterprises in the study area.

H_1: Farmers socio-economic characteristics (age and education) significantly influence indicators of CSAP on groundnut farming household enterprises.

Evaluation of hypotheses for the objective

The probability value of age and education socio-economic characteristics of 0.003 and 0.046 for groundnut enterprises respectively, are all less than 0.05 and absolute t – value greater than 1.96 shows that CSAP are significant at the standard of 1% and 5% for age and education significant level respectively. Therefore, the researcher rejected the null hypothesis and accepted the alternative hypothesis which stated that farmers' socio-economic characteristics such as age and education significantly influence indicators of CSAP on groundnut enterprises.

CONCLUSIONS AND POLICY RECOMMENDATIONS

This research work was motivated and encouraged by the increasing consequences of climate change and its bearing on the poverty status of the rural farmers. The current poverty situation in Nigeria is alarming, and it is exacerbated by food insecurity, an upshot of climate change. This necessitated the examination of CSAP and poverty level of the groundnut farming households in Katsina State, Nigeria. The selected research questions addressed was: What are the factors influencing indicators of CSAP on groundnut farming household enterprise? The study employed descriptive statistical analysis, PCA and ordinary least square regression models analysis to address these research questions. The study indicated that age ($p<0.01$), education ($p<0.05$) and farm size ($p<0.10$) were significant determinants of the use of CSAP for the

Table (i) Multi-Collinearity Test of Variables

Variable	VIF	Tolerance	Eigen Value
Age	2.60	0.3846	13.6796
Gender	2.02	0.4948	1.3705
Education	1.13	0.8864	1.0070
Marital	1.84	0.5442	0.9167
Religion	1.23	0.8153	0.7666
Households	1.67	0.6000	0.6502
Farm size	1.33	0.7545	0.4881
Experience	2.38	0.4197	0.4179
Ownership	1.88	0.5329	0.3874
Land acquisition	1.50	0.6650	0.3274
Labour	1.07	0.9388	0.2417
Membership	1.59	0.6304	0.2287
Transportation	1.15	0.8688	0.1257
Housing material	1.28	0.7829	0.0988
Communication	1.24	0.8080	0.0913
Extension contact	1.05	0.9525	0.0728
Lack of access to credit	1.46	0.6865	0.0524
Lack of time	1.15	0.8660	0.0355
State	1.45	0.6911	0.0227
Expenditure	1.31	0.7650	0.0123
			0.0067
Mean VIF	1.52		

Source: *Author's Computation from the Computer Printout of Multicollinearity Test*

Table (ii) Factors Influencing the Indices of Climate Smart Agricultural Techniques on Groundnut Enterprise

Groundnut csa enterprise	Coefficient	Standard error	t-value	p-value
Age	.0372305	.0123537	3.01	0.003*
Gender	-.435532	.4039346	-1.08	0.282
Education	-.2101668	.1050433	-2.00	0.046**
Marital	.178331	.4336107	0.41	0.681
Religion	.2281706	.2809566	0.81	0.640
Households	-.0138106	.0295129	-0.47	0.417
Farm size	.0487316	.0249054	1.96	0.051***
Experience	-.0177124	.0121637	-1.46	0.146
Ownership	.2138104	.3998113	0.53	0.593
Land acquisition	.4268788	.3484556	1.23	0.222
Labour	-.1263712	.2395089	-0.53	0.598
Membership	.0719808	.1718534	0.42	0.676
Transportation	-.2455936	.2414468	-1.02	0.310
Housing material	-.3052228	.2245575	-1.36	0.175
Communication	-.0748344	.1529925	-0.49	0.625
Extension contact	-.0685198	.0613396	-1.12	0.265
Lack of access to credit	.0202029	.1645736	0.12	0.902
Lack of time	.0570541	.1531026	0.37	0.710
State	.1558512	.1638895	0.95	0.432
Expenditure	1.99e-06	6.15e-06	0.32	0.747
Constants	-1.393806	.6601566	-2.11	0.036
Number of Obs:	294			
F (20, 273)	1.71			
Prob> F	0.0320			
R-Squared	0.1111			
Root MSE	1.1681			

Source: Author's Computation from Computer Printout of Regression Analysis
*Note: *, ** and *** means 1%, 5% and 10% level of significance respectively*

groundnut farming household enterprise. Finally, the farmers' socio economic factors greatly influence indicators of CSAP on groundnut enterprises decrease.

The findings of the study suggest several policy implications as follows:

(i) The results show the significant determinants of the use of CSA for the groundnut enterprises. The most recurring significant variables were age, education and farm size. These determinants could therefore constitute the benchmark for adequate policies aimed at improving CSAP for each enterprise.

(ii) The study recommends that massive campaigns be carried out in educating the youths regarding the importance of agriculture production activities and how sustainable it can be when using CSAP. The importance could equally be emphasised in the school curriculum so as to diffuse the misleading urge for white collar jobs and focus on where the talents lead you. Formal education and Arabic or Qur'anic educational curriculum should be enriched with climate smart agricultural information and should be agriculturally focused. This will serve as bait for household farmers in the study area because education was one of the major significant variables.

(iii) There is need to invent new ways of encouraging education in the study area. The government has done a considerable work in this aspect, the most significant being the universal basic education. Nonetheless, it is still necessary to make such considerations for post primary educational levels so as to get those who eventually become farmers more knowledgeable about the business which is becoming more lucrative and scientific with CSAP and not just planting and then wait for harvest time activities.

(iv) The rural farmers since they are getting involved in the practices gradually. Moreover the consequences of climate change effect, on all and sundry, has been alleged to increase poverty levels among farmers. It is therefore only logical to practise CSA so as to be sustainably increasing in agricultural productivity, income, adapt and build resilience to climate change, reduce or eliminate green-house gas emission which enhances achievement of national food security and reduce poverty in the long run.

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