IMPACT OF NIGERIAN AGRICULTURAL INSURANCE SCHEME(NAIS) ACCESS ON FARM PRODUCTIVITY AND INCOME STATUS OF SMALLHOLDER FARMERS IN SOUTH EAST, NIGERIA

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ABSTRACT

This study compared the impact of NAIS access on farm productivity and income status of smallholder farmers in south east, Nigeria. A sample size of 400 smallholder farmers were sampled through a multi-stage purposive sampling and interviewed using a well-structured questionnaire. Frequency and percentage distribution, logit and ordinary least square regression (OLS) models were used for analyzing data. The coefficients of age, farm size, labour cost, farm inputs, education, access to compensation and extension contacts obtained were positive and statistically significant at P<0.05) and P<0.01) levels of probability. Results further revealed that six of the explanatory variables included in the model were statistically significant at (0.01 < P < 0.1 and P<0.05) probability levels. It is recommended that more insurance companies be supported to augment already existing efforts by NAIS to enroll more smallholder farmers in South Eastern states of Nigeria and reap the benefit therein.

Keywords: Agriculture, Insurance, Access, Farmer, Productivity, Income Status

INTRODUCTION

Farm production is always risky as it is highly dependent on the climate. It is widely recognized that agricultural enterprises are prone to risks and uncertainties. A risk is defined as a situation where all possible outcomes of an activity are known along with the probability associated with the occurrence of each possible outcome. Uncertainty, on the other hand, arises either where all the possible outcomes of an activity are not known, or the probabilities of the outcomes are not known, or neither the outcomes nor their probabilities are known. There is often the underlying recognition that agricultural practices may not yield expected results. This is because, unlike manufacturing, farmer's decisions at the ploughing and planting stages do not yield instantaneous results, thereby giving room for unpredictable intervening factors such as weather, pests and diseases, natural disasters, etc. to influence outcomes (Esheya, 2012). The smallholder farmers are less sophisticated and vulnerable to various risks in agricultural production including production and weather risks. These risks are due to unforeseen weather, disease, pest infestations and market conditions causing wide variations in yields and commodity prices. The type and severity of risks vary by crop, farming system, agro-ecological conditions and policy and institutional settings (De-Janvry, Dequiedt & Sadoulet, 2014). However, production risk due to weather uncertainties and variabilities, particularly those associated with deficient rainfall remains pervasive. Weather shocks pose a major challenge to increasing productivity among smallholder farmers in developing countries, particularly so in the face of climate change (Ankrah, Kwapong, Eghan & Adarkwah, 2021).)Several smallholder farming households consequently are faced with the prospects of tragic crop failure, livestock mortality, food insecurity, dispossession and migration. Climate-related hazards constraints economic prospects derived from agriculture thus disrupt rural economies (Reyes, 2017).

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Most of the rural population are involved in agriculture and are facing many challenges to cover the risk of production such as market risks and production risks that leads to unstable and unpredictable income years after years. Though some risks could be managed by farmers, but other risks cannot be managed by them. Rural people or farmers face difficulties to address such kind of risks. For managing these risks, farmers need to get outside help (Sharker, 2013). A myriad of strategies exists to mitigate agricultural risks. These include investments in infrastructure (e.g., irrigation facilities), technological innovations (e.g., drought-tolerant cultivars), crop management practices (e.g., changes to the timing of production activities), and financial instruments (e.g., credit or insurance). Unfortunately, most of these strategies are often either not available or not feasible for many resourced constrained farmers in developing countries (Mahul & Stutley, 2010).Agricultural insurance has been identified to be a very important tool in assisting farmers, herders and governments lessen some negative financial impact of adverse natural events. Apparently, insurance has been used by many countries to help manage agricultural risks. Obviously, the usefulness of agricultural insurance in risk mitigation is not in question (Smith & Glauber, 2012).

Aneke (1998) defined insurance as the elimination of the uncertain risk of loss for the individual through the combination of a large number of similarly exposed individual who can contribute to a common fund, premium payment sufficient to make good the loss caused by anyone individual. Insurance is also defined as a social device providing financial compensation for the effects of misfortune, the payment being made from the accumulated contributions of all parties particularly in the scheme. Insurance involves the substitution of a small known cost for the possibility of a large but uncertain loss. It is a provision made for the protection of persons or property against risk and uncertainty. Insurance is a contract which the insurer agree to pay a premium to the insurer and the insurer agrees to indemnify the insured against loss resulting to him or her on the happening of certain events or to pay a certain sum of money on the occurrence of a specified event. As a contract, the insurer promises to indemnify (compensate) the insured against loss that he may suffer in future, upon the payment of a premium (Esheya, 2021).

Agricultural insurance is an agreement in which a farmer pays to an insurance company premium for the company to help and indemnify the cost of losses, accident, injury and unpredicted environmental factors that are likely to affect crop and livestock output wherever they occur (World Bank, 2011). Agricultural insurance is a financial tool to transfer risks associated with farming to a third party via payment of a premium that reflects the true long term cost to the insurer assuming those risks. Agricultural insurance is a special line of property insurance applied to agricultural firms. In recognition of the specialised nature of this type of insurance, insurance companies operating in the market either have dedicated agribusiness units or outsource the underwriting to agencies that specialise in it (Bamiro, 2012). According to Akubuilo, Umeabali, Mgbada, Ugwu, Egwu and Awoke (2007), agricultural insurance gives farmers a minimum protection against the risk of crop or livestock failure in return for the payment of a stipulated premium. In the event of losses, the insured farmer claims indemnity as a matter of right and eventually the losses are wholly or partly shared by the insured farmers themselves. Such contractual right to assist further enables farmers to improve their credit worthiness and stabilizes their income. This is a source of confidence to farmers as they venture into the adoption of innovation; because removes the fear of using credit facilities by guaranteeing a protection against loan repayment (Esheya, 2011).

Agricultural insurance as an alternative for risk management actually started as crop hail insurance in Europe, more than 100 years ago, and it spread to the United State at the beginning of the century. It has since been embraced by a lot of developed and developing countries of the

World, viz- USA, Canada, Japan, Mexico, Brazil, Bolivia, Coast Rica, Panama, Mauritius, India, Australia, Iran, Sri Lanka, Zambia, Philippine, Israel, Chile, Jamaica, Egypt, Cyprus, Sweden, Bangladesh and Venezuela- with varying degrees of successes and failures (OECD, 2009). Agricultural insurance is defined in the Nigerian Agricultural Insurance Scheme (NAIS) operation guideline (1989) as the stabilisation of income, employment, prices and supplies of agricultural products by means of regular and deliberate savings and accumulation of funds in small installment by many farmers in favorable time periods, to defend some or a few of the participants in bad time periods.

In Nigeria, commercial agricultural insurance scheme was pioneered by Niger insurance in May, 1987. National Insurance Corporation of Nigeria (NICON) fully owned by the Federal Government and the National Cooperative Insurance Society of Nigeria (NCISN) were also known to have operated insurance schemes with agricultural implication on a limited commercial scale. Similarly, some banks such as the United Bank for Africa (UBA) and Union Bank of Nigeria which were actively involved in giving credit facilities to the agricultural sector had to raise the sum assured of life assurance of loan applicants to qualify as suitable collateral for providing loan. Agricultural insurance scheme (NAIS), which was formerly launched on the 15th of December, 1987, was later followed by the incorporation of the Nigeria Agricultural Insurance Company (NAIC) in 1988 to implement the scheme (Aina & Omonona, 2012). Prior to the establishment of NAIC, Nigerian farmers suffered various losses on their investment and had no means of going back to production. The frustration made them to move into cities in droves in search of easy means of livelihood. This situation led to depletion of farming populace, which was a serious threat to food security (Amusa, Anugwo, & Esheya, 2017).

The Federal Government was disturbed by the ugly trend, hence the establishment of NAIC to address the need of farmers. The need for a specialised agricultural insurance company to provide insurance cover to farmers was informed by Government's concern over the vacuum created due to the unwillingness of conventional Insurers to accept Agricultural risks, which they considered too risky. This led to the establishment of the Nigerian Agricultural Insurance Scheme on 15th of November, 1987.The implementation of the Scheme was initially vested in the Nigerian Agricultural Insurance Company Limited, which was later incorporated in June, 1988 but later turned into a Corporation in 1993 by the enabling Act 37 of 1993. Nigerian Agricultural Insurance Corporation is therefore a wholly-owned Federal Government of Nigeria insurance company set up specifically to provide agricultural risks insurance cover to Nigerian farmers. Its vision is to remain the pioneer and leader in the country's agro-investment risk management and the preferred choice for general insurance with a mission to making investment in Agriculture and other sectors of the economy more attractive through efficient risk management that ensures prompt settlement of claims thereby improving Agricultural output and promoting National Development (Bamiro, 2012).

Despite agricultural insurance advocacy, in contemporary times as an important tool in mitigating agricultural risks, insurance access and utilisation has been sluggish in Nigeria. Reasons attributed to the low access include low awareness and knowledge of agricultural insurance, information asymmetry and poor understanding of insurance by rural farmers (Belissa, 2019). Few studies (Bamiro, 2012; Akubuilo, et al., 2007; Aneke, 1998; Ndegwa, 2020; Aina, & Omonona, 2012) have focused on examining the trends in insurance availability, accessibility and utilisation. Ankrah et al. (2021) underscores the need for the reasons accounting for low insurance access and acceptability to be identified and addressed. This study bridges this gap in knowledge as it was aimed at comparing the impact of NAIS access on farm productivity and income status

of smallholder farmers in south east, Nigeria. The specific objectives were to**:** describes the socio- economic characteristics of NAIS access and non-access farmers; determinants of farm productivity among NAIS access and non-access farmers; determinants of income status among NAIS access and non-access farmers; and identify the constraints to NAIS access and utilization in the study area.

Materials and Methods

The study was carried out in the five south eastern states of Nigeria namely Abia, Anambra, Ebonyi, Enugu and Imo states. Five (5) local government areas were drawn from each of the states while 10 registered farmers were randomly selected from each of the 20 selected local government areas to obtain a total of 200 smallholder farmers who are not accessing NAIS. Again, the list of NAIS accessing smallholder farmers was obtained from the NAIC office and a total of 200 farmers who are accessing NAIS in the study area were randomly selected. Thus, a sample size of 400 smallholder farmers were sampled through a multi-stage purposive sampling and interviewed. Information was obtained directly from the smallholder farmers through interviews using interviewer-administered structured questionnaires. Secondary data on types of agricultural insurance products, insurance coverage, premia paid for various insurance products, types of crops insured and trends in accessibility and utilization of policies by smallholder farmers were obtained from the office of NAIC and analyzed accordingly. Both descriptive and inferential statistical tools were used for data analysis.

Analytical Techniques:

I. Ordinary least square regression (OLS) model

The OLS regression analysis gives the technical relationship between the various inputs specified (independent variables) and the farm productivity (dependent). The OLS regression was used to estimate the impact of NAIS access on respondents' farm productivity (Kg). The model was specified in implicit form as:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8,)$----------(1)

$Y = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e$ ----------(2)

Where:

Y = Farm productivity (Kg);

X_1 = Farm size (hectare);

X_2 = Labour input (man day);

X_3 = Age (years)

X_4 = Farming experience (years);

X_5 = Farm inputs (access =1, otherwise = 0);

X_6 = Access to NAIS (compensation received in naira, otherwise = 0);

X_7 = Education (number of years of formal schooling);

X_8 = Extension contact (number of contact in a year);

e = error term;

βo = constant term;

$\beta_1 - \beta_8$ = Regression coefficients to be estimated variables.

ii. Logit regression model

The empirical model used for determining the factors that influenced income status among NAIS access and non-access smallholder farmers is stated thus:

Pi = f (Z) = log 1− Σn1 βiZi ---------- (3)

Pi denotes the probability that the farming households is below or above the poverty line, βi are the coefficients and Zi are poverty determinants variables.
The model can be written in terms of the probability of being poor as:
pi= (0+) (1 + exp(β0+ βiZi) ……..…….(4)
Where:
pi is probability of being poor,
β0 are constants and βi and Zi as defined in equation (3)
It was specified in implicit form as:
$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8,)$----------(5)
The model was specified in explicit form as in the equation:
$Y = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e$ ----------(6)
Where:
Y = Income status of the respondents (1= Rich, 0 = Poor);
X_1 = Age (years)
X_2 = Education (number of years of formal schooling);
X_3 = Farm size (hectare);
X_4 = Farming experience (years);
X_5 = Cost of inputs (Naira);
X_6 = Labour cost (man day);
X_7 = Access to market (Km);
X_8 = Access to Credit (Naira)
e = error term;
βo = constant term;
β_1 -β_8 = Regression coefficients to be estimated variables.

Results and Discussion

I. Socioeconomic characteristics of respondents

Results in table 1 show that the average age of the NAIS access and non-access respondents were 36 and 37 years respectively. It further show that greater percentage (53.5% and 60.5% respectively) of the NAIS access and non-access farmers are within the age range of between (41-50) years which implies that the respondents were young, active and productive in agricultural and income-generating activities. Again majority (59.0%) and (49.0%) of the respondents attended secondary school indicating that majority of them can read and write. The level of farmer education is used to measure the ability to read and positively relate to insurance uptake, ceteris paribus. Table 1 also shows that the average household of the access and non-access categories are 10 and 12 members respectively. The household size according to Jiriko (2012) is an important factor in agricultural production and other economic activities because it influences, to a large extent the supply of labour for immediate farm work. The mean farm size for both categories of respondents was 2 hectares indicating smallholding capacity because Olayide, Eweka, and Bell-Osagie (1980) classified farm size of between 0.1 to 5.9 hectares as small farms. They have average farming experience of 21 and 20 years respectively.

Table 1: Distribution of respondents by socioeconomic characteristics

Variable	Access Frequency (%)	Mean	Non- Access Frequency (%)	Mean
Age(years)				**37**
31-40	42(21.0)	**36**	34(17.0)	
41-50	107(53.5)		121(60.5)	
>50	51(25.5)		45 (22.5)	
Education level (years)				
Primary education	26(13.0)		63(31.5)	
Secondary educ.	118(59.0)		98(49.0)	
Tertiary education	56(28.0)		39(19.5)	
Household size (no.)				
1-3	61(29.5)	**10**	98(47.1)	**12**
4-6	126(60.0)		99(47.1)	
>7	22(10.4)		12(5.7)	
Farm size(ha)				
< 2	25(11.9)	**2.0**	46(21.9)	**2.0**
2.0- 4.0	148(70.9)		130(61.9)	
>4	36(17.2)		33(19)	
Farming Exp. (years)				
1-10	09(4.3)	**21**	13(6.2)	**20**
11-20	109(51.9)		140(66.7)	
21-30	79(37.6)		52(24.8)	
>40	12(6.2)		4(2.4)	
Cooperative Association				
Member	164(82.0)		23(11.5)	
Non-member	36(18.0)		177(88.5)	
Extension Contact				
Yes	21(10.5)		12(6.0)	
No	179(89.5)		188(94.0)	
NAIS awareness				
Aware			18 (9.0)	
Not aware			182 (91.0)	
Number of training received				
None	54 (27.0)		183(91.5)	
1-4	125 (62.5)		17(8.5)	
5 and above	21(10.5)		0(0.0)	

Source: Field Survey, 2020. Note: Figures in parentheses are percentages.

About 82.0% of the NAIS access farmers belong to cooperative societies while only (11.5%) of the non-access respondents do. This result is in tandem with the findings of Gashaw, Gian, and Kindle (2013), who stated that membership of cooperatives enhances members' access to credit facilities, productive inputs and extension services, compared to those who are not members. Unfortunately, majority (89.5% and 94.0% respectively) of the access NAIS access and non-access respondents do not have extension contact, with little or no training. This also contributed to the low level of awareness (9.0%) among the NAIS non-access smallholder farmers on the existence of the scheme in the study area. The frequency of extension contact between the extension personnel and the smallholder farmers would enlighten the latter and create better awareness for the potential gains from improved agricultural innovations (Odoemenem & Obinne, 2016).

i. Farm productivity of NAIS access and non-access smallholder farmers

Farm productivity of NAIS access and non-access farmers was estimated by using the best fit regression model in Table 2 below. The semi-log functional form was chosen as the lead equation and has adjusted R square of 0.66. This implies that 66% of the variability of farm productivity among the NAIS access and non-access smallholder farmers was explained by the explanatory variables (age, farm size, labour, farm input cost, access to compensation, education and extension contact). The coefficients of age, farm size, labour cost, farm inputs, education, access to compensation and extension contacts obtained were positive. This indicates that the variables have direct relationship with the farm productivity of the respondents. The coefficient of age was found to be negative and significantly related with farm productivity at P<0.10) level of probability. The estimated coefficient of 7.87 implies that the farm productivity of smallholder farmers with NAIS access will decrease by a magnitude of 7. 87 percent as age increases by a unit. This could be because as age increases, strength, agility and vigour decreases (Esheya, 2019).Results in table 2 further show that the coefficient of farm size was found to be positive and significantly related with the productivity of NAIS access farmers. Foluronso (2016), stated that, the coefficient (0.31010) for farm size is statically significant at 1% level of probability which shows that land as an input has major influence on farm productivity. The regression coefficient of labour cost was found to be negative and significantly related with farm productivity at 10% level of probability.

Table 2: Regression estimates of farm productivity and socio-economic factors

Variables	Access Coefficients	Standard Error	t-value	Non-access Coefficients	Standard Error	t-value
(Constant)	-10.054**	4.181	-2.404	-1.548*	0.925	-1.673
Farm size	0.970***	0.186	5.21	0.332***	0.028	11.857
Labour input	-0.485*	0.280	-1.734	0.261***	0.100	2.61
Age	-0.787*	0.455	-1.729	-0.139	0.093	1.494
Farm experience	0.239	0.256	0.933	0.023	0.040	0.575
Farm inputs	0.527**	0.268	1.965	-0.037	0.059	-0.633
Access to compensation	0.821***	0.295	2.783	0.001	0.067	0.014
Education	0.063**	0.028	2.25	-0.021	.018	-1.166
Extension Contact	0.0542**	0.221	2.45	-0.012	0.062	-0.193

Source: Field Survey, 2020. **Note**: *** P< 0.01, ** P<0.05 & * P<0.10.

The estimated coefficient of -485 implies that the farm productivity of NAIS access farmers will decrease by a magnitude of 4.85 percent as labour cost increases. The coefficient of farm inputs (0.527) and compensation paid (0.821) had the expected positive relationship with the farm productivity NAIS access smallholder farmers and was significantly at P<0.05) and P<0.01) level of probability. This finding is corroborated by Ojiako, Tarawali, Okechukwu and Chianu (2017) whose investigation of the determinants of productivity of smallholder farmers supplying cassava to starch processors in Nigeria, found that there was significant positive influence of easy access to farm inputs on farm productivity. Education and extension contact were positive and significant at P<0.01) level of probability. Ogunbameru, Gwari, Idris, Ani, and Yero (2006) identified extension contact, access to market, level of education, access to credit, access to land and taking part in decision making as the, determinants of crop output among women farmers of urban agriculture in Borno State, North-east, Nigeria.

i. Income status of NAIS access and non-access smallholder farmers

Table 3 shows the maximum likelihood estimates of the coefficients of the logit model of determinants of household income status in the study area. Result of the analysis revealed that six of the eight explanatory variables included in the model were statistically significant (0.01 < P < 0.1 and P<0.05) respectively**.** The model accounted R2 (0.693) for 69.3% of the variation in income status of NAIS access and non-access smallholder farming households in the study area. Age, education, farm size and access to credit were statistically significant for both categories of respondents while labour cost and access to market were statistically significant for NAIS non-access smallholder farmers only.This position is consistent with that of Rodriguez (2002) that poverty increases with old age, as the productivity of the individual decreases. The coefficient of education was also significant (p<0.05). This is in line with a prior expectation that the higher the literacy levels of the household head, the lower the likelihood of the household becoming poor. Farm size had a positive coefficient (0.435) and was significant at P<0.01 level of probability. This implies that farm size is an important income status determinant in the study area and significantly influences the probability that a household would be poor or not. Access to market also had positive coefficient (0.006), but was insignificant variable in determining income status. Credit assists the farm households in the purchase of farm inputs such as fertilizers, herbicides, improved seeds and investment demand to increase productivity.

Table 3: Factors influencing income status of respondents

Variables	Access Coefficients	Standard Error	t-value	Non-access Coefficients	Standard Error	t-value
Constant	1441.0	8024.3	0.179	1.963***	0.693	2.832
Age	0.054***	0.014	3.857	1.961***	0.689	2.846
Education	0.414**	0.169	2.449	0.08	0.099	0.808
Farm size	0.435***	0.052	8.365	0.014	0.010	1.40
Farm Experience	1.440	0.342	4.210	-0.050	0.054	-0.925
Farm inputs cost	0.014	0.040	0.350	-0.004	0.073	-0.054
Labour cost	0.012	0.010	1.200	0.919***	0.107	8.588

Access to market	0.006	0.023	0.260	0.504***	0.1172	4.300
Access to credit	-1.00011***	0.0000	6.810	-0.263	0.397	-0.662
Pseudo R^2 = 0.693				0.753		

Source: Field Survey, 2019. **Note:** *** P< 0.01, ** P<0.05 and * P<0.10.

The coefficient of access to credit was significant at (P<0.05) level and negatively related to the poverty status of the farm households. This is not surprising, as credit can reduce liquidity constraints and increase the capacity of households to start off-farm businesses. This is in line with the findings of Babatunde and Qaim (2009) who reported that access to credit has a positive influence on income status of smallholder farm households. Farm labour cost income had a positive coefficient and was significant at P< 0.01 level of probability. This implies that farm labout cost is an important variable in poverty status determination and that it significantly influenced the probability of household income status. According to Apata and Rahji (2017), there is a minimum level of education necessary to enhance appreciation and adoption of new technologies for increasing household productivity, income and standard of living. Therefore, a unit increase in the level of education of farm households head increased the probability of the households' standard of living.

Conclusion

This study was undertaken to determine the impact of NAIS access on farm productivity and income status of smallholder farmers in the south eastern states of Nigeria. Agricultural insurance is a useful tool for managing agricultural risks and it extends as a good mitigation strategy of risks in almost all fields of human endeavors. NAIS is a leading agricultural insurance service provider to smallholder farmers in the study area. The results of this study show smallholder farmers' access and acceptability of agricultural insurance is low, scarce and constrained by limited knowledge of agricultural insurance products. Access and utilisation of Nigeria Agricultural Insurance Scheme are further influenced by age, education, awareness level and wrong perception concerning agricultural insurance products in the study area. It is recommended that more insurance companies be incentivized to augment already existing efforts by NAIS to enroll more smallholder farmers in the South Eastern states of Nigeria.

Recommendations

i. Federal government should ensure that more insurance companies are incentivized to augment the efforts of NAIS.

ii. Smallholder farmers should be educated and sensitized about existing agricultural policies and their attributes to encourage potential subscription, uptake and reduction of farm risks and uncertainties.

iii. Smallholder farmers should be encouraged to join cooperative societies so as to improve their income status and enhance insurance uptake.

REFERENCES

Aina, O.S. & Omonona, B.T. (2012). 'Nigeria Agricultural Insurance Scheme (NAIS): Prospect, Achievement and Problems'. *Global Advanced Research Journal of Agricultural Science, 1(5),* 97- 103.

Akubuilo, C.J.C., Umeabali, E.E., Mgbada, J.U., Ugwu, D.S., Egwu, W.E. & Awoke, M.U. (2007). Readings in Agricultural Economics and Extension. Enugu: Computer Edge Publishers.

Amusa, T. A; Anugwo, S. C; & Esheya, S. E. (2017). Factors influencing processors' willingness to engage in mechanized palm fruits processing in Abia state, Nigeria. *The Nigeria Agricultural Journal*, 48(2), 236-247.

Ankrah, D.A., Kwapong, N. A., Eghan, D. & Adarkwah, F. (2021). Agricultural insurance access and acceptability: examining the case of smallholder farmers in Ghana. *Agriculture and Food Security*, 10, 19-26.

Aneke, J.I. (1998). Principles and Practice of Insurance. Lagos: Johnkens and Willey.

Apata, T.G. & Rahji, M.A.Y. (2017). Poverty and poverty status in oil producing communities of Ondo state, Nigeria. *Agro-search*, 9(1-2), 1-9.

Babatunde, R.O. & Qaim, M. (2009). Patterns of diversification in rural Nigeria: Determinants and impacts. *Quarterly Journal of International Agriculture*, 48(4), 305-320.

Bamiro, O. M. (2012). Economics of Vertical Integration in the Poultry Industry.

KGSaarbrucken, Germany: LAP LAMBERT Academic Publishing GmbH & Co.

Belissa, T. *(2019)*. Liquidity constraints, informal institutions, and the adoption of weather insurance: A randomized controlled trial in Ethiopia. *Journal of Development Economics,* 140:269–78.

De-Janvry, A., Dequiedt, V. & Sadoulet, D. (2014). The demand for insurance against common shocks. *Journal of Development Economics*, 106, 227–38.

Esheya, S. E. (2021). Economic Analysis of Gari Processing in Ebonyi State, Nigeria. *Nigerian Agricultural Journal (NAJ), 52 (1):* 237-241

Esheya, S.E. (2019). Economics of cassava production in Ohaukwu local government area of Ebonyi state, Nigeria. *AKSU Journal of Agricultural Economics, Extension and Rural Development,* 2 (2): 92 – 98.

Esheya, S. E. (2012). Economic effects of limestone exploitation on crop production in Ebonyi State. *International Journal of Agricultural Economics, Management and Development*, 2, 124-144.

Federal Ministry of Agriculture and Rural Development. (2011). 'The Nigerian Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL)'. Retrieved from www.fmard.gov.ng on 10th March 2022.

Folorunso, S. T (2016). Impact of FADAMA III on productivity, food security and poverty status of root and tubers crops farmers in North Central states of Nigeria. *Unpublished Ph.D Thesis,* Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria.

Jiriko, R. K. (2012). Impact of Project Agape Microcredit (NGO) on trading, income and level of living of women agricultural traders in Nasarawa State. *Unpublished PhD Thesis*, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Mahul, O. & Stutley, C. J. (2010). Government support to agricultural insurance: challenging and options for developing countries - annex E (English). DC: World Bank Washington; 2010.

Ndegwa, M.K. (2020). Uptake of insurance-embedded credit in presence of credit rationing: evidence from a randomized controlled trial in Kenya. *Agricultural Finance Review*, 3 (2) 21-30.

Odoemenem, I.U. & Obinne, C.P.O. (2016). Assessing the factors influencing the utilization of improved cereal crop production technologies by small-scale farmers in Nigeria. *Indian Journal of Science and Technology*, 3(1):180-183.

OECD. (2009). Risk Management in Agriculture: A Holistic Conceptual Framework. Part of the Trade and Agriculture Directorate Project on Risk Management in Agriculture.

Ogunbameru, B. O., Gwari, M. M., Idris Y. L., Ani, A. O. & Yero, A. B. (2006). Empowerment of women through urban agricultural development in Maiduguri metropolitan, Borno state: Development agricultural extension policy for Nigeria. Proceedings of 13th Annual Conference of Agricultural Extension Society of Nigeria (AESON), Maiduguri, Borno State. 3rd – 6th April, 2006, 149.

Ojiako I. A., Tarawali G., Okechukwu R.U & Chianu, J. (2017). Determinants of productivity of smallholder farmers supplying cassava to starch processors in Nigeria: A baseline evidence. *Russian Journal of Agricultural and Socio-Economic Sciences*. Retrieved on 5th March 2022 from https://doi.org/10.18551/rjoas.

Olayide, S., Eweka, J. & Bell - Osgie, V. (1980). Nigeria small farmers: Problems and prospects in integrated rural development in Nigeria. Centre for Agricultural, Rural and Development (CARD), University of Ibadan, Nigeria Publisher.

Reyes, C.M. (2017). *Agricultural insurance program:* Lessons from different country experiences. 2017, PIDS Discussion Paper Series.

Rodriguez, J. G (2002). The determinant of poverty in Mexico. Accessed on 10th March 2022 from:www.gdnet.org/pdf/2002awardswinners/growthinqualitypoverty/jorggarzarodriguezpaper.pdf.

Smith, V.H. & Glauber, J. W. (2012). Agricultural insurance in developed countries: where have we been and where are we going? *Application to Economic Perspective Policy*, 34(3), 363–90.

Sharker, D. (2013). Weather Index Insurance for Agriculture in Bangladesh: Significance of implementation and some challenges. *European Journal of Business and Management*, 5 (14), 20-33.

The World Bank, (2011). Weather index insurance for agriculture: Guidance for development practitioners, *Agriculture and Rural Development discussion paper, 50*, 6.

fertilizer, local varieties, suboptimal plant population, insect pests infestation etc. (Saha *et al*., 2005, Iyagba *et al.,* 2012).

Chadha, (2002) has reported that optimum plant density is the key element for higher fruit yields of okra, as plant growth and yield are affected by inter-and intra-row spacing. Yield is also affected by the use of manure as it results in improvement of soil physical and chemical properties, organic matter content and consequently nutrients (Oyedeji, 2014). Most farmers cultivating okra are located in the rural areas and often do not use manures on their fields which could boost fertility and maintain good soil health. Similarly, having lower number of crops planted per unit area results in low plant population and consequently total yield. Thus, the research was conducted to determine the effect of poultry manure rates and planting patterns on the productivity of okra in Samaru, Northern Guinea Savanna of Nigeria.

Materials and Methods

The trial was carried out during the 2018 and 2019 rainy seasons at the Research Farm of the Institute for Agricultural Research, Samaru. Treatments consisted of four rates of poultry manure (0, 4, 8 and 12 t ha^{-1}) and four planting pattern populations {1 stand/ one ridge side (33, 000), 1 stand/ two side of ridge (66, 000), 2 stands/ one ridge side (66, 000), 2 stands/ two side of a ridge (132, 000)} laid out in a Randomized complete block design replicated three times. Gross plot size was 12m^2 while the net plot was 6m^2. Parameters were taken on plant height, number of leaves, finger length, finger diameter and yield. Data collected was subjected to analysis of variance as described by Snedecor and Cochran (1967), using the general linear model (GLM) procedure of the statistical analysis system (SAS) package (SAS, 1990) version 9.1. Treatment means were separated using Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion

Soil physical and chemical properties during 2018 and 2019 rainy seasons are presented on Table 1. Result indicates that the soil is loamy in nature in both years, which will help to retain water and nutrients. Soil pH fell within acceptable range (6.40) required for good crop performance. The organic carbon, total nitrogen and available phosphorus were generally low in the two years of study. Moderate exchangeable bases (Ca, Mg and Na), while K was high in 2018 and 2019.

Table 2 shows some of the chemical properties of the poultry manure used for the trial in percentage. Generally, nitrogen (1.69), phosphorus (0.58) and potassium (0.42) contents were low. Based on the analysis, N in the manure can supply 169 kg N in 10 tonnes (10,000 kg) of the manure (200 bags of 50 kg bag), P_2O5 in the manure can supply 56 kg P_2O_5 in 10 tonnes (10,000 kg) of the manure (200 bags of 50 kg bag), while K_2O in the manure can supply 42 kg K_2O in 10 tonnes (10,000 kg) of the manure (200 bags of 50 kg bag). Results of the poultry manure analysis means that it can also supply the nutrients required by the okra plants thus the increases recorded.

Effect of poultry manure and planting patterns on number of leaves and plant height of Okra in 2018 and 2019 rainy seasons are presented on Table 3. In both years, application of poultry manure from 0- 4 t ha^{-1} significantly increased Okra height, but beyond that rate no significant increment was observed. On number of leaves, in 2018, application of 12 t ha^{-1} of poultry manure significantly produced more leaves than the control or 4 t ha^{-1} but not significantly different with application of 8 t ha^{-1}. In 2019 however, application of 8 or 12 t ha^{-1} of poultry manure resulted in significantly higher number of leaves than the control but comparable to plots applied with 4 t ha^{-1}. Planting pattern resulted in no significant increment on these parameters in both years and the interacting factors were also not significant.

The increase in plant height and number of leaves as a result of applied manure could be attributed to its role in improving soil organic matter and consequently soil fertility. The increase in soil fertility might have enhanced the ability of the crop to grow taller, produce more leaves for photosynthetic efficiency.

Table 1: Physical and chemical Properties of Soil Samples taken from 0-30 cm depth at the experimental site in 2018 and 2019 wet season.

Physical characteristics (g/kg)	**2018**	**2019**
Sand	500	500
Silk	420	420
Clay	80	80
Textural class	Loam	Loam
Chemical properties		
pH in H_2O (1:2.5)	6.40	6.40
pH in CaCl2	5.79	5.79
Organic carbon (g/kg)	8.50	8.50
Total Nitrogen (g/kg)	0.75	0.83
Available Phosphorus (mg/kg)	5.34	5.34
Exchangeable bases (cmol/kg)		
Calcium (ca)	2.81	2.81
Sodium (Na)	0.21	0.21
Potassium (k)	5.34	5.34
Magnesium (mg)	0.46	0.46

Analyzed at Department of Agronomy, Analytical Laboratory ABU, Zaria.

Table 2: Chemical composition of the poultry manure used in the experiment during the 2018 and 2019 rainy season.

Chemical properties	%
Total Nitrogen	1.69
Total Phosphorus	0.58
Total Potassium	0.42

Analyzed at Department of Agronomy, Analytical Laboratory ABU, Zaria.