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Household Productivity and Poverty Assessment in Northern Nigeria: Evidence of Smallholder Farmers in Sudano-Sahelian Region

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ABSTRACT: *Cross-sectional data were collected from four (4) states (Kano, Jigawa, Bauchi and Gombe) in Northern Nigeria, covering 1,200 households. Primary data were collected using a structured questionnaire to elicit information on respondents' socioeconomic profile, production and Productivity parameters, household expenditure and other factors influencing poverty status. Descriptive statistics, FGT and Logistic regression model, were used for data analysis. The study discovered low access to agricultural finance and poor access to the market, which affected household productivity and overall income. Agricultural production is an important household activity which provides food and basic needs for the improved livelihood of households and communities. The results showed the presence of the majority of male respondents with formal education and access to extension and market. The average land area cultivated by the households was 2.02, with minimum and maximum of 0.55ha and 6.58ha, respectively. The highest proportion was reported for rice, maize and livestock in all the States. The land area productivity shows an average of 2.01ha, 1.92ha, 2.23ha and 2.19ha for Gombe, Bauchi, Jigawa and Kano, respectively. The highest average annual income was 351,284.39 for Kano State, followed by Gombe and Bauchi State (319,480.31 and 304,651.73), respectively. The reported poverty incidence was 71.33%, 69.67%, 70.67% and 64.67 for Bauchi, Gombe, Jigawa and Kano States, respectively. The significant reported variables influencing poverty include output volume, cultivated land area, off-farm income, remittances and educational attainment. The volume of output produced and annual income available are also essential sources for poverty reduction and livelihood improvement in Sudano-Sahelian Region. The poverty incidence is increased with some high severity levels, necessitating development intervention. Reliable poverty alleviation programs and engagement of stakeholders, particularly Government, public and private partners, NGOs, INGOs and donors, should develop and implement measures to facilitate access to basic social services, especially for vulnerable households is vital. Promoting income diversification (farm, off-farm and non-farm sources) and strengthening incentives for increased enterprise engagement and agricultural production is essential in poverty reduction.*

KEYWORDS: productivity, poverty, Sudano-Sahelian

INTRODUCTION

As the most populous country SSA, Nigeria faces challenges concerning reducing the country's dependence on food importation through improvement in food self-sufficiency, especially increased domestic food production and staple crops like rice, and maize, among others. The capacity of agricultural Productivity in a nation determines to a large extent, the level of poverty across households and communities. Poverty is a global phenomenon which threatens the survival of mankind irrespective of race or geographical location. According to NBS (2016), 53.9% of the Nigerian population lives in poverty, of whom 25.1% were defined as "core poor", i.e. extremely poor. Food insecurity has been a serious issue which requires attention for increased Productivity of smallholder farmers in the Savannah of Northern Nigeria. This is a major challenge regarding the targeted policy for poverty eradication, and economic development is largely a rural phenomenon, with the absolute numbers of poor greater in rural areas. Still, city slums also harbour a large proportion of the poor. This implies that policymakers should pay more attention to urban food insecurity and poverty, as the number of urban poor and the depth of poverty in urban areas are increasing. Most of the poor depend directly on natural resources for their livelihood, which is currently threatened due to the over-exploitation of these gifts of nature. Poverty and food insecurity levels varied from State to State, with the States in the North having the highest incidence and the Southern States having the lowest incidence but highest severity (NBS, 2015).

Poverty is a denial of choices and opportunities, a violation of human dignity. It means a lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to, not having the land on which to grow one's food or a job to earn one's living, and not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence and often implies living in marginal or fragile environments without access to clean water or sanitation (World Bank, 2010). In Nigeria, widespread and severe poverty is a reality. It is a reality that depicts a lack of food, clothes, education and other basic amenities. Severely poor people lack the necessities of life to the degree that it can be wondered how they manage to survive. There are several effects and deficiencies associated with poverty in Nigeria. One of the main effects of poverty is poor health, as is reflected in Nigeria's high infant mortality and low life expectancy. Poor people in Nigeria face several health issues as they lack basic health amenities and competent medical practitioners. Most children cannot be immunised, leading to certain physical defects in some children. Their health has become a low priority, and as they have little or no choices, they live with whatever they are provided,

whether healthy or not, including adult food provision, which is the resultant effect of household poverty (World Bank, 2015).

Poverty is multidimensional; thus, measuring it presents several challenges. Beyond low income, there is low human, social and financial capital. The most common approach to measuring poverty is quantitative, money-metric measures which use income or consumption to assess whether a household can afford to purchase a basic basket of goods at a given time. The basket ideally reflects local tastes and adjusts for spatial price differentials across regions and urban areas in a given country. Money metric methods are widely used because they are objective, can be used as the basis for a range of socioeconomic variables, and it is possible to adjust for differences between households and intra-household inequalities (NHDR, 2016). Despite the plethora of anti-poverty programs and policies over the years in Nigeria, poverty remains a serious problem. Dated statistics on poverty in Nigeria from the Nigerian National Bureau of Statistics (NBS, 2010) indicated that poverty was most obvious in the northern part of Nigeria, with the highest rate in Sokoto state, a poverty rate of 86.4%. The North East and North West zones of Nigeria had 77.7% and 76.3% poverty rates, respectively, compared to the South West zone, with a 59.1% poverty rate at the time. The poverty headcount in Nigeria rose from 27.2% in 1980 to 65.6% in 1996. The rate declined by an annual average of 2.1% to 54.4%. Over the same period (1980–1996), the percentage of the poorest people rose from 6.2% to 29.3% and declined to 22% in 2004 (Asogwo, 2012).

Agricultural productivity constraints are related to the poverty level of farming households, which necessitates an in-depth assessment of poverty status and its determinants in the study area (APS, 2014). Therefore, this study considers the productivity and poverty assessment of households in the Sudano-Sahelian region of Northern Nigeria. Based on the aforementioned productivity and poverty challenges faced by households, the study addressed the following specific objectives:

- Describe the socioeconomic profile of the respondents
- Analyse the productivity parameters of the households
- Estimate the poverty status and its determinants in the study area
- Describe the poverty and productivity constraints of the selected households

Conceptual Framework

Poverty is a contested concept; its meaning depends on the ideological and political context within which it is used. However, in the broadest sense, it can be generally understood as the lack of, or inability to achieve, a socially acceptable standard of living or the possession of insufficient resources to meet basic needs. The meaning of 'socially acceptable' or 'basic' often

needs careful debate or specification. It is created and perpetuated by different processes and social relations in different locations and is experienced and conceived differently according to context (Halen, 2011). Many poverty analyses describe the poor condition rather than considering how or why the condition exists. These descriptions typically focus on individual attributes (e.g. a lack of assets, education, health, etc.). However, these attributes are the outcomes of social processes and must be understood within social institutions and systems. To understand, anticipate or attempt to alter these outcomes, it is necessary to understand the structures and processes that underlie these deprivations. Poverty, therefore, needs to be understood as being strongly influenced by the resources that people can claim, under what conditions and with what level of choice. Social differentiation, distributional concerns and power issues are central to poverty analyses. Government structures and other formal and informal processes and institutions govern social relations and power structures, which extend over various spatial, temporal and social scales. These, in turn, affect people's opportunities, their ability to make choices, their access to resources, etc., and therefore the distribution of benefits, costs and risks within and between individuals and groups.

James (2014) The study examined factors influencing poverty and coping strategies among female-headed household rural farmers in Nasarawa State, Nigeria. The study revealed that 51% of the farmers were in the age bracket of 21-50 years, 63% were widowed, 64% with no formal education, 81% had no access to extension contacts, 100% had small farm sizes, 93% had more than 10 years of farming experience and 42% earned gross farm income of less than N50,000. OLS estimation showed a significant R2 of 0.844 (84.4%), indicating a good fit for the model. Farm size, years of farming experience, membership of farmers' association, cost of production and access to credit were the important significant factors determining poverty level in the study area. Skipping meals, reducing the number of meals and purchasing less preferred food items topped the copping poverty strategies. Women's lack of right to land inheritance, dependence on limited personal savings, and inefficient work done by hired labour were some factors perpetuating poverty among the farmers.

The data obtained were analyzed using Descriptive statistics, FGT 1984 poverty index and the probit regression model. The result for primary occupation showed that 47.6% of the respondents in the study area were civil servants, and a larger percentage of 73.3 earned between ₦5,000 and ₦100,000 per month with a mean of N99,245.80k. The study showed that the poverty incidence (P_o) was discovered to be 99%, the poverty depth/gap (P_1) was found to be 98.9%, and the poverty severity (P_2) was 98.8%. The household size of the respondents was significant at 5%, which indicated that it had great importance in determining poverty in the study area and was positive, implying that the larger the household size, the higher the probability of being poor (Amao, Ayantoye and Fadahunsi, 2013).

Benjamin, Victoria, and Joseph (2012) applied a censored regression model approach to analyse the determinants of poverty severity among rural farmers in Nigeria. The study showed that variations in the specified explanatory variables explained 87.63% of the variation in poverty severity. Furthermore, at a 5% level of significance, the critical determinants of poverty severity among the respondents were economic efficiency, household income, dependency ratio, ratio of food expenditure to total household expenditure, farm size, access to credit, household production enterprise structure, the extent of household production diversification, the extent of product commercialization, expenditure on education, access to agricultural extension services, membership of cooperative societies or other farmers' associations, market access, the total value of household assets, household size and formal education. Olorunsanya, Abolude, Babatunde, and Adenuga (2012) examined the determinants of the poverty status of rural farming households in Osun State, Southwestern Nigeria. Descriptive statistics, the Foster, Greer and Thorbecke class of weighted poverty indices, and the Tobit regression model were used to analyse the data generated from the survey. The poverty indices show that 35 per cent of the beneficiaries of the Farmers Empowerment Programme were poor as against 55 per cent for the non-beneficiaries of the programme. The regression results show household size, amount of credit utilised, and annual farm income as the factors influencing the poverty status of the rural farming households in the state. The lower incidence of poverty and access to credit for the beneficiaries of FEP in the state are indications of better welfare for this category of farming households.

METHODOLOGY

Study Area, Sampling and Data Collection

Four (4) Sudano-Sahelian States, specifically Kano, Jigawa, Bauchi and Gombe, were considered for cross-sectional data collection among households. The study area is a potential agricultural location with diverse agricultural and other economic activities across urban and rural communities. The four (4) states were purposefully selected for their importance in Agricultural activities and less security challenge compared to other states to enhance the accessibility of data collection. The study locations were Stratified for scientific sampling, where each state is classified into three (3) agroecological zones. Nine LGAs in each Zone were selected, thus giving a total of 36 LGAs for the study. A simple random sampling technique was used in selecting 10 respondents from each LGAs, which implies 300 respondents per state and a 1,200 sample size for the study. Primary data were collected using a structured questionnaire to elicit household information on respondents' profiles, Productivity and parameters, respectively. The distribution of sample size is depicted in Table 1 below:

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Table 1: Sampling Techniques

State	No. of Zones	No. of LGAs	No. of Respondents
Kano	4	9	300
Jigawa	4	9	300
Bauchi	4	9	300
Gombe	4	9	300
Total	**12**	**36**	**1,200**

Analytical Approach

Descriptive statistics, Foster, Greer and Thorbecke (FGT) Model and Binary logistic regression. The descriptive statistics will involve frequency and percentages, mean distribution and pictographs.

Foster, Greer and Thorbecke (FGT)

The FGT model was used to estimate the poverty status of households. The FGT approach used for this study is based on the mathematical formula which explains poverty indices anchored upon the existence of household classification according to the consumption expenditure approach.

Its mathematical formulation is derived as follows:

$$P_a = \frac{1}{N}\sum_{i=1}^{q} \frac{(z-y_1)^a}{z} \quad ---------- (1)$$

Where,

P = Poverty Index of households

N = the total population of households in the sample,

Z = Poverty line,

q = Number of households below the poverty line,

Y_1 = Expenditure or income of the households

$\propto$ = the degree of concern for the depth of poverty; it takes on the value of 0, 1 and 2 for poverty incidence, poverty gap and poverty severity, respectively. The indices are then derived as follows:

$$P_0 = \frac{1}{N}\sum_{i=1}^{q} \frac{(z-y_1)^0}{z} \quad ---------- (2)$$

which is equal to the headcount ratio. This index measures the incidence of poverty. If the degree of aversion to poverty is increased so that α = 1, the index becomes:

$$P_1 = \frac{1}{N}\sum_{i=1}^{q} \frac{(z-y_1)^1}{z} \quad ---------- (3)$$

Here the headcount ratio is multiplied by the expenditure gap between the average poor person and the line. This index measures the depth of poverty also referred to as the "expenditure gap" or "poverty gap" measure. Although superior to P_0, P_1 still implies uniform concern about the depth of poverty in that it weights the various expenditure gaps of the poor equally. P_2, or

expenditure gap squared index, allows for concern about the poorest of the poor by attaching greater weight to the poorest's poverty than those just below the line. This is done by squaring the expenditure gap to capture the severity of poverty:

$$P_2 = \frac{1}{N}\sum_{i=1}^{q}\frac{(z-y_1)^2}{z} \quad (4)$$

Binary Logistic Model

By obtaining the poverty status of households from the FGT model. A logistic regression model was used to determine the factors influencing the poverty status of households. Binary logistic regression requires the dependent variable to be converted into a dichotomous binary variable coded 0 and 1. The binary logistic regression methodology has been employed in several agricultural, economic and extension studies that call for the analysis and prediction of a dichotomous outcome such as fertilizer use or non-use, adoption and non-adoption, food secured and food insecure, poor and non-poor, and other general binary dependent variable). The logistic regression model has been popularly applied in analyzing the factors influencing the food security status of rural farming households. A similar model was used by James (2014). Others used multiple regression, tobit (Oluransanya, 2012) and probit (Amoa, Ayantayo and Fadahunsi, 2013). The dependent variable for logistic regression is binary, taking a value of 1 non-poor household and 0 for a poor household in the study area. This eventually expressed itself as the implicit form of the logistic regression, which can be expressed as:

$$Y_{ij} = X\beta + U \quad (5)$$

The explicit form of the stepwise logistic model can be expressed in the following model:

$$Y_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \ldots + \beta_k X_k + U \quad (6)$$

Where,

Y_{ij} = Dependent variable, poverty incidence of the household (1 = non poor and 0 = poor household)

X_1 = Volume of output (kg)

X_2 = cooperative participation (Member 1, Non-member 0)

X_3 = Age of HH Head (years)

X_4 = Household size (Number)

X_5 = Market access (Access 1, No access 0)

X_6 = Access to credit (1= access and 0= No access)

X_7 = Farm size (ha)

X_8 = Off-farm income (₦)

X_9 = Extension contact (Contact 1, No contact 0)

X_{10} = Remittances (₦ /Annum)

X_{11} = Educational status (years)

β_0=Slope or intercept

β_1- β_{10} = Coefficient of regressors
U = error term

RESULTS AND DISCUSSION

Demographic Profile of the Respondents

Age refers to the number of years a person has lived. It is the length of time that a person has lived or existed. It explained the years of the farmer at the time of the study. The findings revealed an average age of 41 years for the respondent, which is appropriate for active engagement in farming activities. The average appropriate age indicates that most of the farmers across states both fall within their active age, which may give them the opportunity to participate in active production. This shows an element of sustainability in household agricultural enterprises. The experience in agricultural production for the respondents correlates with active age, where the majority have production experience. Household size refers to the total number of individuals who live within and feed from the same pot. According to the National Population Commission (NPC, 2006), these individuals think of themselves as a unit. According to Ogwumike, F.O. and Akinnibosun, M.K. (2013), household size is the total number of individuals who live within and feed in the same house. The reported average household size was 8 people, which is moderate in the context of African households.

Respondents' distribution based on land area cultivated and amount of credit received is depicted in Table 2. The average land area cultivated by the households was 2.02, with minimum and maximum of 0.55ha and 6.58ha, respectively. Land area cultivated for agriculture is quite sufficient to produce for the farming families and commercialization, especially when appropriate inputs, good agronomic practices and market access are implemented. On the other hand, the average amount of credit received was 261,470.59 for households, respectively. Access to finance improves farmers' ability to obtain quality and credible production inputs for increased productivity. Farmers with proper access to finance at the appropriate time are more likely to acquire production inputs for increased Productivity. Mamman, Wudil and Halliru (2016) also reported poor access to credit among smallholder farmers. Distance to market was also an important variable affecting household enterprise and access to input and output market.

The average distance to the market was 9.5 kilometres, with minimum and maximum distances of 0.5 and 32.5 kilometres, respectively. Closer markets allow the farmers to access production inputs such as seeds, fertilizers, agrochemicals and other farm implements for production activities. Proximity is an essential pillar of market access and reduction in the total cost of input and output transportation by households.

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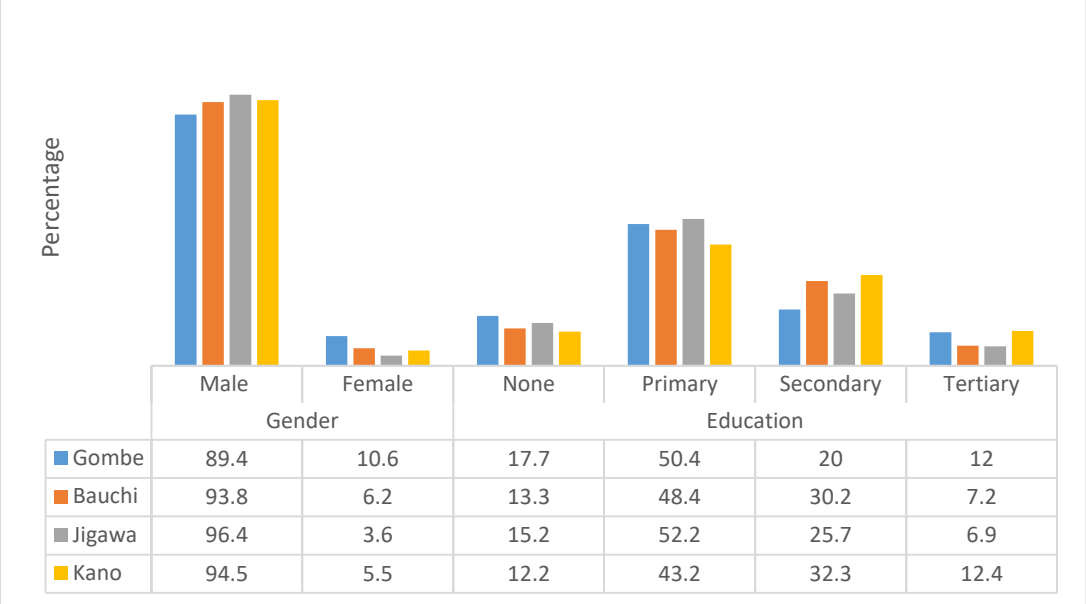
Table 2: Age, Experience, Farm Size and Credit Assessment

Variables	Min.	Max.	Mean	S.D	S.E
Age (years)	24	78	41	3.195	2.335
Experience (years)	07	34	11	1.652	0.918
Household Size (No.)	01	16	08	1.388	1.953
Total Land Area (ha)	0.55	6.58	2.02	0.954	0.445
Credit Amount (N)	150,000	985,600	261,470.59	1.862	2.119
Nearest market distance (km)	0.5	32.5	9.5	0.366	1.132

Gender and Educational Status of Respondents



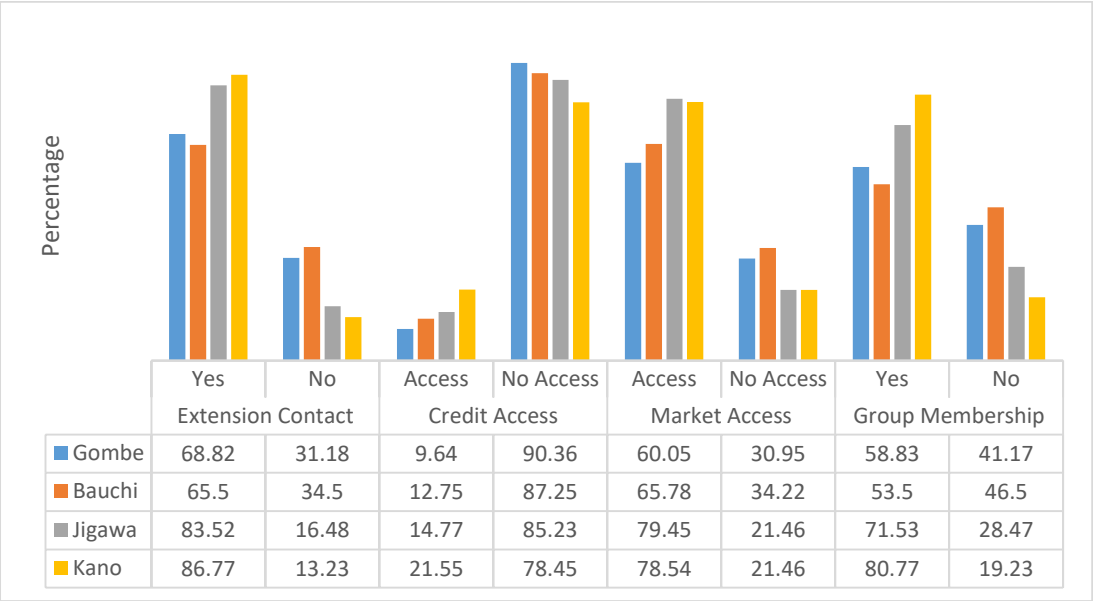
	Male	Female	None	Primary	Secondary	Tertiary
Gombe	89.4	10.6	17.7	50.4	20	12
Bauchi	93.8	6.2	13.3	48.4	30.2	7.2
Jigawa	96.4	3.6	15.2	52.2	25.7	6.9
Kano	94.5	5.5	12.2	43.2	32.3	12.4

Figure 1: Gender and Educational Status of Respondents

FAO defines gender as 'the relations between men and women, both perceptual and material. It is a central organizing principle of societies and often governs the processes of production and reproduction, consumption and distribution' (FAO, 2013). The result from figure 1 depicts that most of the respondents across the locations Kano (94.5%), Jigawa (96.4%), Bauchi (93.8%) and Gombe (89.4%) were male. This may be attributed to the culture, tradition and religion of the people living within these locations. It may also be a result of other social activities associated with social responsibilities within the households that limit female engagement in other social activities outside the household. The result implies that male-dominated farming activities and other social activities within the locations deprive females of engagement in farming and social activities, which may also contribute toward food security and improve their livelihood. These findings align with the work of Babatunde et al. (2007), where most (90.4%) of the respondents considered in their study were male.

Toyin, M.E and Mushunje (2016) defined education as 'the wealth of knowledge acquired by an individual after studying particular subject matter or experiencing life lessons that provide an understanding of a particular thing. The result of educational status further shows that most of the respondents had formal education across the locations Kano (88.8%), Jigawa (84.8%), Bauchi (86.7%) and Gombe (82.3%), with respondents having one form of formal education or the other which shows that the respondents can be able to read, write and equality understand and analyse situations that came along their ways for improvement in their life. Having these forms of formal education implies that the respondents can use their knowledge to address an issue that has to do with food security by adopting different technologies that will help improve their food production to make their locations food secure and the nation in general, which will equally improve their livelihood. These findings agreed with Babatunde et al. (2007), who found that the majority (52.1%) of their respondents had one form of formal education.

Extension Contact Membership and Access to Credit/Market



	Yes	No	Access	No Access	Access	No Access	Yes	No
	Extension Contact		Credit Access		Market Access		Group Membership	
Gombe	68.82	31.18	9.64	90.36	60.05	30.95	58.83	41.17
Bauchi	65.5	34.5	12.75	87.25	65.78	34.22	53.5	46.5
Jigawa	83.52	16.48	14.77	85.23	79.45	21.46	71.53	28.47
Kano	86.77	13.23	21.55	78.45	78.54	21.46	80.77	19.23

Figure 2: Extension Contact Membership and Access to Credit/Market

The information in figure 2 revealed market access among the respondents where most (of the respondents across the locations Kano (78.54%), Jigawa (79.45%), Bauchi (65.78%) and Gombe (69.05%) have market access. The availability of nearby marketplace plays a significant role among respondents in the study area. Having access to the market among the respondents implies that they can market their produce for income or exchange; they can also engage in any marketing activities for income generation to be able to cater for the need of households and, at the same time, different access kind of food at their disposal in ensuring food security within their household. These findings disagree with that of Mamman et al.

(2016), who reported 80.67% of their respondents to have access to credit. Findings further revealed that most of the respondents across the locations Kano (78.45%), Jigawa (85.23%), Bauchi (87.25%) and Gombe (90.36%) have no access to credit. One of the constraints militating against food production, especially among small and medium-scale farmers, was inadequate capital. Accessibility to credit helps in acquiring the necessary capital for production. The poor access to credit among the respondents may be associated with poor awareness of the procedure to access the credit, high-interest rates charged by commercial banks, provision of collateral and conservativeness of farmers. Therefore, failure to access credit will significantly affect agricultural production, considering the current inflation. By implication, food security will also be affected. Ogunniyi et al. (2021) reported that 81% of the respondents have market access and obtain market information.

The results on extension contact reported positive status as most respondents claimed yes across the four states. Extension contact is considered an instrument that facilitates the learning and adoption improved production practices that directly impact household productivity (Figure 2). Ahmed, Eugene and Abah (2015) assessed the food security status of farming households and reported that extension contact is an essential instrument which has been inadequate among smallholder farmers in Nigeria. The majority of the respondents further reported positive, cooperative participation. Participation in farmer groups strengthens interaction by sharing ideas and skills and collective decisions and actions such as group purchase and market information sharing.

Household Productivity Assessment

Major Household Enterprises

Table 3: Proportion of Major Crops/Livestock Produced

Major Crops	**Gombe**	**Bauchi**	**Jigawa**	**Kano**
Rice	56.5	58.5	85.6	89.42
Maize	65.41	59.34	52.11	60.54
Millet	34.21	33.67	30.85	41.86
Sorghum	21.54	26.41	33.69	40.19
Sesame	10.51	11.88	30.44	24.62
Wheat	3.45	4.89	14.56	19.83
Groundnut	24.53	21.68	28.32	31.51
Cowpea	18.45	23.25	36.54	38.77
Vegetables	20.35	21.71	43.56	52.49
Fruits	8.45	9.68	13.53	15.49
Livestock	56.45	50.31	69.55	68.56

The information in Table 3 provides details of the proportion of major crops produced by the households. It can be observed that major staple crops are produced across the States for household consumption and market purpose. The highest proportion was reported for rice, maize and livestock in all the States. Kano was reported to have the highest proportion of household enterprises in the major crops and livestock, followed by Jigawa and Gombe State, respectively. The presence of staple and commercial crop production across Northern Nigeria is a symbol of Agricultural potential and progress, which is expected to increase and subsequently facilitate poverty reduction.

Household Productivity Assessment

Table 4: Household Productivity Parameter

Productivity Parameters	**Statistics**	**Gombe**	**Bauchi**	**Jigawa**	**Kano**
Farm size (ha)	Minimum	0.51	0.31	0.48	0.34
	Maximum	4.56	3.92	5.43	4.93
	Mean	2.01	1.92	2.23	2.19
Farm output (tons)	Minimum	0.85	0.53	1.03	1.87
	Maximum	10.21	9.84	13.51	14.56
	Mean	4.58	3.96	5.69	5.23
Annual Income (₦)	Minimum	104,340.41	114,890.63	98,875.94	141,450.61
	Maximum	756,348.12	690,450.81	815,785.49	805,547.33
	Mean	319,480.31	304,651.73	298,567.13	351,284.39

The study further assessed household productivity parameters such as land area cultivated, farm output and average annual income, respectively. The land area productivity shows an average of 2.01ha, 1.92ha, 2.23ha and 2.19ha for Gombe, Bauchi, Jigawa and Kano, respectively. Their average farm size is appreciable to support agricultural production for home consumption and market purposes. The farm output was aggregated from the major crops to generate the households' status on Productivity. The highest average annual income was 351,284.39 for Kano State, followed by Gombe and Bauchi State (319,480.31 and 304,651.73), respectively.

Assessment of Household Poverty Status

Table 5: Assessment of Household Poverty Status

States	**Non-Poor**	**Poor**	**Total**
Bauchi State			
Poverty Incidence (P_0)	86	214	300
Percentage Incidence (%)	28.67	71.33	100.00
Poverty Depth (P_1)	1.348	-0.316	
Poverty severity (P_2)	3.281	0.198	
MPCHHE	30,316.80	10,289.43	

Poverty Line			17,980.24
Gombe State			
Poverty Incidence (P_0)	91	209	300
Percentage Incidence (%)	30.33	69.67	100
Poverty Depth (P_1)	1.972	-0.522	
Poverty Severity (P_2)	5.433	0.393	
MPCHHE	38,775.19	14,219.63	
Poverty Line			25,452.56
Jigawa State			
Poverty Incidence (P_0)	88	212	300
Percentage Incidence (%)	29.33	70.67	100
Poverty Depth (P_1)	0.363	-0.394	
Poverty severity (P_2)	4.194	2.095	
MPCHHE	39,275.43	10,621.53	
Poverty Line			26,267.16
Kano State			
Poverty Incidence (P_0)	106	194	300
Percentage Incidence (%)	35.33	64.67	100
Poverty Depth (P_1)	0.521	-0.396	
Poverty severity (P_2)	35.165	2.115	
MPCHHE	42,720.22	18,459.82	
Poverty Line			29,282.71

The poverty status of farming households revealed that 71.33% were poor while only 28.67% were non-poor in Bauchi state (Table 5). This indicates high poverty in Bauchi state, which may not be unconnected to household production level and economic engagement. Food can be available for households classified as poor due to additional parameters for measuring poverty. This is because poverty variables are beyond food security requirements as they comprise food and non-food parameters such as schooling, healthcare, transport, energy, and housing, among others. Igbalajobi (2013) also reported that the majority of the household was poor, while very few were non-poor in most communities in Nigeria. However, the poverty depth for the poor and non-poor was -0.316 and 1.348, implying that the non-poor are far above the poverty line while the poor are far below the poverty line. This can be testified considering the MMPCHHE of 30,316.80 and 10,289.43 for non-poor and poor households, with the poverty of 17,980.24 for Bauchi State. In Gombe State, the majority (69.67%) were poor, while 33.33% were non-poor. The poverty depth in NGS was 1.972 and -0.481 for non-poor and poor, respectively. Amoa, Ayantayo and Fodahunsi (2013) reported that most farming households in the Northeastern region were poor, with inadequate access to production inputs, markets and other basic amenities. The poverty line in Gombe was high, 25,452.56, compared

to Bauchi State, with MMPCHHE of 38,775.19 and 14,219.63 for non-poor and poor households, respectively. The results were also similar in Jigawa State, where 70.67% of smallholder farmers were poor, with poverty depth and security of -0.394 and 0.363 for poor and non-poor households. This implies a high distance of the poor household below the poverty line (26,267.16). Kano State's results were slightly different, which reported decreasing incidence of poverty as represented by 35.33% and 64.67% for non-poor and poor households. This agrees with the findings of James (2014), who conducted a study on factors influencing poverty and coping strategies of rural farmers in Nigeria, where it was reported that most of the respondents were poor.

Determinants of Poverty Status in the Sudano-Sahelian Region

The result from the table shows that the dependent variable (poverty status of smallholder maize farmers) took a value of 1 for non-poor households and 0 for poor households. The independent variables considered in the stepwise logistic estimation include maize yield, cooperative membership, farmers' age, household size, access to credit and market, farm size, off-farm income and extension contact. Significant variables influencing poverty status include maize output, age, household size and farm size.

Table 6: Factors Influencing Food Security Status in Sudano-Sahelian Region

Variables	**β**	**S.E**	**Wald**	**Sign.**	**Exp (β)**
The volume of output (kg)	-0.103	0.408	11.766	0.001*	0.318
Cooperative membership (Binary)	0.631	0.196	39.331	0.727	0.109
Age of the farmer (years)	-0.042	0.010	20.191	0.655	0.766
Household size (No)	-0.102	0.019	53.145	0000**	0.142
Access to credit (Binary)	-0.094	0.147	11.861	0.116	0.089
Access to market (Binary)	0.497	0.469	12.810	0.833	1.816
Farm size (ha)	-0.016	0.074	0.962	0.005*	0.178
Off-farm income (₦)	-0.085	0.164	0.781	0.018*	1.055
Extension contact (Binary)	0.074	0.216	0.846	0.741	0.455
Remittances (₦ /Annum)	-0.112	0.177	8.219	0.008**	0.571
Educational status (years)	-0.032	0.193	6.813	0.006*	0.218
Model Statistics					
-2loglikelihood	236.109				
Cox &snell estimate	0.361`				
Neglekerke estimate	0.416				
Model chi-square	152.611***				

As shown in table 6, the estimated logistic regression model indicated that the statistical parameters that express the "goodness of fit" of the model specified for this study are highly significant at a 5% probability level. The chi-square (x^2) of 152.611 and its degree of freedom (df) respectively indicate support for the model and imply that the model containing the intercept and the independent variables are accepted. The Cox and Neglekerke estimates of 0.361 and 0.416 suggested that between 36.1% and 41.6% variance observed in the model is attributed to the contribution of the regressors involved in the analysis. The log-likelihood of 236.109 further confirmed the estimated model's validity and reliability in explaining the selected variables' statistical influence.

The coefficient of output volume was negative and significantly related to the poverty status of small maize farmers at $P<0.20$. This implies that an increase in output volume has a decreasing effect on household poverty. This might be possible because more farm output help households acquire food for the family, more assets and finance production for subsequent season. Household size was also negative and significantly influenced poverty in the study area. With several contributing respondents' increases, it is expected that their capacity to contribute positively increases over time through labour provision on farms and other economic engagements. Asogwa (2012) estimated the determinants of poverty depth among farmers in Nigeria. The result revealed that household income, farm size, age and education influence farmers' poverty status. The result further revealed a significant negative relationship between household size and poverty status. The findings align with the study by Benjamin, Victoria and Joseph (2012), who analyzed the determinants of poverty severity among rural farmers in Nigeria. Ogwumike and Akinnibosun (2013) also report household size as a significant determinant of poverty in rural areas.

Farm size was also found to have a significant inverse relationship with the poverty status of smallholder maize farmers. This implies that farmers who devoted more farm size with appropriate management to agricultural production are more likely to be food secure compared to those with a small portion of land. The land is an important variable that determines the level of output to some extent. James (2014) also reported that farm size is an important determinant of rural household poverty status. However, the findings indicated that other variables, such as access to credit, extension contact and off-farm income, decrease poverty status but are not significant. To support these findings, Asogwa (2012) reported that significant factor that influences poverty was total economic efficiency, household income, farm size, household size, age, education, farming experience, access to gainful credit employment for household members, membership of farmer association, extension contact and valuable farm assets. Other important variables reported as significant factors influencing poverty include remittances and the education status of the household. Households with members living in the city and engaged

in economic activities are more likely to send resources back home for family upkeep. This assists the households in purchasing food, clothing, and shelter and facilitating farming investments.

CONCLUSION AND RECOMMENDATIONS

The study discovered a lack of access to agricultural finance and a lack of market access, which impacted household productivity and overall income. Agricultural production is an important household activity that provides food and necessities for improved household and community livelihoods. The amount of output produced, and the available annual income is also important sources of poverty reduction and livelihood improvement in the Sudano-Sahelian Region. The poverty incidence is increased with some high severity levels, necessitating development intervention. The study based on the findings, therefore, recommends the following:

1. A policy that would facilitate poverty reduction strategies and how to implement them should be put in place by Government through the support of NGOs, INGOs and donors.
2. Engagement of stakeholders, particularly Government, public and private partners, NGOs, INGOs and donors, should develop and implement measures to facilitate access to basic social services, especially vulnerable households.
3. Promoting income diversification (farm, off-farm and non-farm sources) and strengthening incentives for increased enterprise engagement and agricultural production is essential in poverty reduction. This will facilitate income dependency and additional asset provision for the households.
4. Household heads should be properly educated on the importance of family planning measures and remittances by members to have a manageable family size that will exist on the available and limited resources.

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