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ADOPTION OF SUSTAINABLE AGRICULTURAL PRACTICES AMONG SMALLHOLDER ROSELLE FARMERS IN JIGAWA STATE, NIGERIA

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ABSTRACT

A 2025 study in Jigawa State, Nigeria, profiled 256 smallholder roselle farmers to understand why they do or do not adopt Sustainable Agricultural Practices (SAPs). Most farmers are male (95 %), married (78 %), 39 years old on average, and cultivate 3 ha inherited mainly through inheritance; 69 % have tertiary education, yet 73 % lack extension contact and 66 % belong to no cooperative. Awareness of SAPs is high: 88 % know crop rotation, 82 % optimum spacing, and 82 % organic manuring. However, actual adoption is driven by four significant factors: household size, farm size, roselle farming experience, and whether farming is the primary income source. The chief barriers are high input costs, limited credit, poor extension reach, and unstable roselle prices. To accelerate uptake, researchers recommend that the Jigawa State government introduce targeted incentives—subsidised improved seed, organic fertiliser, and low-interest loans—while recruiting and training more extension agents to deliver continuous technical backstopping and capacity building, ensuring roselle production becomes environmentally and economically sustainable for smallholders.

Keywords: Sustainable Agricultural Practices, Adoption, Roselle, Smallholder Farmers, Jigawa State, Nigeria

INTRODUCTION

The urgent quest for sustainable agricultural development is crucial for meeting the needs of the growing global population while ensuring environmental health and economic viability (FAO, 2018). Sustainable Agricultural Practices (SAPs) are widely recommended as the best means to address food security and mitigate the impacts of climate change (Pham et al., 2021; Setsofia et al., 2022). These practices encompass techniques that enhance productivity, build resilience, and maintain environmental quality, often by reducing reliance on agrochemical inputs and utilizing locally available resources (Khatri-Chhetri et al., 2016; Zewald et al., 2018). Despite their proven benefits, the adoption rate of SAPs remains low among farmers in developing countries, including those in Sub-Saharan Africa (Kagoya et al., 2018; Oyetunde-Usman et al., 2020). Farmers' adoption decisions are influenced by a complex interplay of socioeconomic characteristics, institutional support, and the perceived attributes of the innovations themselves (Dessart et al., 2019; Rizzo et al., 2024). A critical first step in the adoption process is awareness, which shapes farmers' perceptions and willingness to try new practices (Ashrit & Thakur, 2021).

Roselle production in Nigeria serves as an important source of income to rural farmers in Northern Nigeria, as the area is conducive for its production due to dry and arid climate. Roselle farming contributes significantly to Nigeria's GDP, with an annual export value of over 35 million US dollars. The global hibiscus market is expected to grow at a Compound Annual Growth Rate (CAGR) of 6.8 percent from 2020 to 2027, driven by the increasing demand for herbal tea and natural ingredients in the food and cosmetics industries. Report by market research organization, Grand View Research (2020) shows that the global rosselle market size was valued at 6.3 billion dollars in 2020 and is expected to reach 9.9 billion dollars by 2027, with a compound annual growth rate of 6.4 percent from 2020 to 2027.

Nigeria is one of the largest rosselle producer globally, with an annual production of over 500,000 metric tons (AHFEN, 2023). Other rosselle producing countries in Africa include Senegal, Egypt, Sudan and Mali. Demand for hibiscus is on the rise. This creates an important opportunity for hibiscus farmers in Nigeria. The local market for hibiscus is thus expanding as more Nigerians especially smallholder farmers are becoming aware of its economic and health benefits.

In Jigawa state northern Nigeria, rosselle (*Hibiscus sabdariffa*) is an important cash crop, the state is one of the leading producerss (AHFEN, 2023). The crop has significant economic value, with a growing global market. To sustain and benefit from this market opportunity, rsoselle farmers need to adopt SAPs. However, there is a scarcity of empirical research on the awareness and drivers of adoption of these practices specifically among rosselle farmers in Jigawa State.

Therefore, this study aims to bridge this knowledge gap by analysing the adoption of SAPs among smallholder rosselle farmers. The specific objectives are to:

i. Describe the socioeconomic characteristics of the farmers.
ii. Assess their level of awareness of different SAPs.
iii. Determine the factors influencing the adoption of SAPs.
iv. Identify the constraints faced in adopting SAPs.

MATERIALS AND METHODS

Study Area

Jigawa State was carved out from Kano state on Tuesday 27th August, 1991. It composes of 27 Local Government Area with Dutse as its capital. Jigawa is one of the 36 states of Nigeria, located in northwest geopolitical zone between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E. It shares borders with Kano and Katsina State to the west, Bauchi state to the East and Yobe state to the Northeast. It also shares an international border with the Republic of Niger

to the north, which serves as a unique opportunity for cross-border trading activities (Mukhtar, 2023). It has a total population of 4.361.002 million people and ranked the 8th most populous state in Nigeria (NPC, 2006). However, NPC (2006) state's population is projected to reach 7,499100 million by 2023, based on 3.5% annual population growth. Almost 80 percent of the population engaged in agriculture mostly at subsistence level. The inhabitants of Jigawa State are majorly Hausa, Fulani and Kanuri. Jigawa State has a total land area of approximately 23,154 square kilometres. The climate in Jigawa State is semi - arid or tropical and characterized by two main seasons. The short rainy season of about 5 months (May to September) and a long dry season of about 7 months. The state experienced annual rainfall between 600 mm to 1,000 mm with an average of about 650mm over the last few years (Mukhtar, 2023).

Much part of Jigawa State is located in Sudan savannah vegetation zone with small part in guinea savannah. Jigawa state therefore produce rosselle, rice, millet, cowpea, guinea corn, sesame, as major crops, during raining season. And carrot, onion, tomato, pepper, wheat are produced mostly during dry season (JGMA, 2013).

Sampling and Data Collection

A multistage sampling procedure was employed. First, all four agricultural zones in the state were selected. Second, two Local Government Areas (LGAs) prominent in rosselle production were purposively selected from each zone, resulting in eight LGAs. Third, three communities were selected from each LGA, giving a total of twelve communities. Finally, using a sample frame of 876 rosselle farmers obtained from the Kenaf and Roselle Farmers Association, a sample size of 265 farmers was determined using Krejcie and Morgan's (1970) table. The sample was proportionally allocated to each community.

Primary data were collected through structured questionnaires. The instrument was designed to capture data on socioeconomic characteristics, awareness, and constraints related to SAPs.

Data Analysis

Data were analysed using descriptive statistics (frequencies, percentages, means, and ratings) and inferential statistics. A binary logistic regression model was used to determine the factors influencing the adoption of SAPs. The model was specified as follows:

$$\text{Logit}(P) = \text{Ln}[P/(1-P)] = \beta_0 + \beta_1X_1 + \beta_2X_2 + ... + \beta_{16}X_{16} + \varepsilon \quad (1)$$

Where: P = Probability of adopting SAPs (1=adopt, 0=not adopt).

The independent variables (X_1 to X_{16}) included age, gender, marital status, household size, education, income source, cooperative membership, farming experience, farm size, extension access, land ownership, and perceptions of SAPs' complexity, profitability, trialability, and compatibility.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

The result in Table 1 show that majority of respondents were male (94.7%), married (78.1%), and had a mean age of 39 years, indicating a population within their active and productive years. The average household size was 7 persons, which can be a source of family labour. A significant proportion (68.8%) had formal education, which is often associated with a higher number of farmers to adopt new technologies. Farming was the primary source of income for 57.4% of the farmers. The average rosselle farming experience was 5 years, and the mean farm size was 3 hectares, classifying them as smallholders. Critically, most farmers (72.5%) had no access to extension services, and 66.0% did not belong to any cooperative society, highlighting a significant gap in institutional support.

Table 1: Socioeconomic Characteristics of the Respondents (n=265)

Variable	Category	Frequency	Percentage	Mean
Age (Years)	20-30	87	32.8	39.0
	31-40	79	29.8	
	41-50	57	21.5	
	51 and above	42	15.9	
Gender	Male	251	94.7	
	Female	14	5.3	
Marital Status	Married	207	78.1	
	Single	36	13.6	
	Divorced/Widowed	22	8.3	
Household Size	1-5	107	40.4	7.0
	6-10	78	29.4	
	11 and above	80	30.2	
Educational Status	No Formal Education	80	30.2	
	Primary	40	15.1	
	Secondary	64	24.2	
	Tertiary	81	30.6	
Primary Occupation	Farming	152	57.4	
	Other (Business/Salary)	113	42.6	
Farming Experience (Yrs)	1-5	192	72.5	5.0
	6-10	56	21.1	
	11 and above	17	6.4	
Farm Size (Hectares)	1-2	117	44.2	3.0
	3-4	73	27.5	
	5 and above	75	28.3	
Access to Extension	No	192	72.5	

Variable	Category	Frequency	Percentage	Mean
	Yes	73	27.5	
Co. Membership	No	175	66.0	
	Yes	90	34.0	

Source: Field survey, 2025

Awareness of Sustainable Agricultural Practices

The result in Table 2 shows that crop rotation (87.6%), optimum spacing (82.3%), and organic manuring (81.5%) show high level of awareness. This high level of awareness is a positive indicator and a necessary precursor to adoption. The result indicated that there is general high level of awareness, hence farmers are likely adopting the ones that suit their situation. The findings is similar with Inuwa et al. (2025) who reported that awareness was high for improved seed varieties planting method pest and disease control. This finding is also similar to that of Orifah et al. (2021) in his study on adoption of climate smart agricultural practices that, farmer's awareness was highest for early maturing varieties, early planting, use of organic fertilizer and zero tillage.

Table 2: Level of Awareness of Sustainable Agricultural Practices (n=265)

Roselle SAPs	Frequency	Percentage	Decision
Crop rotation	232	87.55%	Aware
Improved seed	194	73.21%	Aware
Optimum spacing	218	82.26%	Aware
Organic manure	216	81.50%	Aware
Integrated Pest Management	184	69.43%	Aware
Minimum tillage	176	66.42%	Aware
Precision planting	179	67.55%	Aware
Fertilizer application	183	69.06%	Aware
Earthen-up	177	66.80%	Aware
Intercropping	186	70.19%	Aware
Cover-cropping	212	80.00%	Aware
Proper harvest practice	195	73.58%	Aware
Proper shortage practice	195	73.58%	Aware
Organic farming	143	53.96%	Not aware

Source: Field survey, 2025

Factors Influencing Adoption of Sustainable Agricultural Practices

Table 3 presents the results of binary logistic regression model of the factors (independent variables) influencing the adoption of rosselle sustainable agricultural practices among rosselle farmers in Jigawa State Nigeria. The model fits the data reasonably well as indicated by the -2loglikelyhood value of 122.099. The Cox & Snell R-square (0.089) and the Negarlkerke R-square values suggests that the model explains a moderate amount of variance in the dependent variable with the Negarlkerke r-square (0.209) indicating a relatively better fit. The results also revealed also, household size had a positive coefficient and significant effect (β=0.114, $p<0.05$), indicating that larger households were more likely to adopt SAPs, possibly due to the availability of family labour for implementing these practices (Wordofa et al., 2021), major Source of income had a negative coefficient and significant influence (β=-0.600, $p<0.05$). This implies that farmers relying solely on farming as their primary income were less likely to adopt, possibly due to risk aversion and capital constraints. Farming experience had negative and significant relationship (β=-0.128, $p<0.05$), suggesting that more experienced farmers may be more resistant to changing traditional practices. Farm size had a negative and significant effect (β=-0.356, $p<0.05$), which contrasts with some studies (Hu et al., 2022) but may indicate that smaller-scale farmers in this context are more intensive and willing to adopt practices to maximize yields from limited land.

Table 3: Binary Logistic Regression Analysis of Factors Influencing SAPs Adoption

Variables	Coefficients	Standard Error	Significance (p-value)	Exp(B)
Household size	0.114**	0.052	0.030	1.120
Educational status	0.438	0.238	0.065	1.550
Income sources	-0.600**	0.281	0.033	0.549
Cooperative membership	-0.069	0.536	0.897	0.933
Farming experience	-0.128**	0.061	0.035	0.880
Farm size	-0.356**	0.151	0.018	0.700
Extension access	-0.189	0.557	0.734	0.828
Complexity of SAPs	1.134	0.621	0.068	3.109
Profitability of SAPs	-0.431	0.635	0.497	0.650
Compatibility of SAPs	1.106	0.606	0.068	3.023
Trialability of SAPs	0.342	0.584	0.559	1.407
Incentives on SAPs	0.455	0.544	0.403	1.577
Constant	2.300	1.060	0.030	9.976
-2loglikelyhood	122.099			

Cox & Snell R-square	0.89
Negarkerke R-square	0.209

Source: Field survey, 2025

Note: Only significant and key control variables are shown for brevity

Constraints Faced by the Respondents in Adoption of Roselle SAPs

Table 4 presents constraints faced by the roselle farmers in adopting rosselle sustainable agricultural practices in the study area. The major constraints faced by the respondents were high cost of farm inputs (x=3.55), access to loan (x=3.48), poor access to extension services (x= 3.43), fluctuating price of rosselle (x=3.38), poor access to information on rosselle SAPs (x=3.34. However, difficulty in implementing rosselle SAPs (x=2.34) and incompatibility of the SAPs (x=1.97) were not constraints to roselle SAPs adoption. The result of the study agrees with that of Muhammad et al. (2022) Who reported that some problems such as non- availability of loans, lack of processing machines, poor capital base, high cost of agrochemicals, pest and diseases, cost of improved production practices, and lack of adequate market among others, constrained sesame farmers from adopting improved sesame production practices in Dutse peri-urban area. Thus, the finding indicated that, roselle farmers are facing many problems that may constraint them from fully adopting roselle SAPs in the study area, and possibly leading to poor adoption.

Table 4: Distribution of Respondents Based on the Constraints

Items	Mean	Decision
Cost of farm inputs	3.55	Constraint
Educational level	2.60	Constraint
Small farm size	3.10	Constraint
Inadequate capital	3.29	Constraint
Access to improved seeds	2.62	Constraint
Ownership of farm status	2.87	Constraint
Poor access to extension services	3.43	Constraint
Inadequate Roselle market	2.57	Constraint
Pest and disease incidence	2.88	Constraint
Adopting practice cost	2.67	Constraint
Access to loan	3.48	Constraint
Poor access to SAPs information	3.34	Constraint
Roselle low production	2.83	Constraint
Incompatibility of SAPs	1.97	Not a Constraint
Implementing SAPs difficulties	2.34	Not a Constraint
Lack of incentives from government	3.17	Constraint
Poor soil fertility	2.77	Constraint
Severe impacts of climate change and variability 2.97		Constraint
Food security status	3.28	Constraint
Fluctuating price of Roselle	3.38	Constraint

Source: field survey, 2024

Note: A decision rule of 2.50 mean was set, thus any mean >2.50 is considered as constraint and means below 2.50 are not constraints.

CONCLUSION

Empirical evidence from 256 smallholder roselle farmers in Jigawa State confirms that while awareness of sustainable practices is high, actual adoption hinges on household size, farm size, farming experience and dependence on crop income. To translate these determinants into higher uptake, the Jigawa State Government should immediately establish a "Roselle Green-Bridge Programme" that integrates three mutually reinforcing actions: (i) a 50 % subsidy on improved seed, organic fertiliser and bio-pesticides to neutralise high input costs; (ii) single-digit, group-based micro-credit to ease capital constraints; and (iii) deployment of at least one extension agent per 500 farmers trained to deliver monthly on-farm demonstrations of crop rotation, optimum spacing and organic manuring. Implementing this bundled package will simultaneously raise farm-level productivity, safeguard natural resources and secure the long-term competitiveness of Jigawa's roselle value chain.

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