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# FACTORS INFLUENCING THE ADOPTION OF LAND MANAGEMENT PRACTICES BY SMALL-SCALE SORGHUM FARMERS IN JIGAWA STATE, NIGERIA

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***Abstract***
*The study examined the adoption of land management practices among small-scale sorghum farmers in Jigawa State, Nigeria. It focused on identifying land management practices, the factors influencing their adoption, and the challenges hindering their adoption. Primary data were collected with the help of a structured questionnaire and analyzed using descriptive statistics and binary logistic regression. Results showed that the majority of respondents were male (98.3%), who were married (96.3%), and had a mean age of 39 years. The average farming experience was 8 years. The majority* (72.2%) of the farmers were members of agricultural cooperatives.Inorganic and organic f*ertilizer application, crop rotation, and irrigation were major land management practices. Factors that influenced land management practices were: age, farm size, number of farm plots, education, and household size.The adoption of land management practices was constrained by high costs of sorghum production inputs, poor transport infrastructure, low availability of improved sorghum seeds, and distance to the nearest market.Accordingly, farmers should be encouraged to diversify their land use. The government, as well as development agents, should educate farmers on ways to produce low-cost inputs to improve farming performance. Extension efforts should include advocacy for the adoption of sustainable and innovative land management practices, such as conservation tillage, cover cropping, irrigation, mixed cropping systems,and agroforestry, to enhance soil fertility and reduce soil erosion.*
**Keywords:**Soil fertility,cover cropping, conservation tillage,crop rotation

## Introduction

Sorghum (*Sorghum bicolor*) stands out as an important food crop in Africa. Literature from Khalifa &Eltahir (2023); Amadu (2025) shows that the crop is the fifth most important cereal crop in the world. Most importantly, sorghum is an important cereal food in the Sahelian, Sudanian, and Guinea Savannah ecological zones of Nigeria. Studies show that Nigeria is the second largest producer of sorghum with an annual production estimate of about 6.7 million tons, grown on an estimated 5.9 million ha of land (Hakeem,Ignatius, Folorunso, Abubakar, Tukur, &Michael,2020). Sorghum is grown mainly for domestic consumption, with excess sold to generate income. Constraints to sorghum production are linked to institutional and physical factors (Ruiz-Giralt, Biagetti, Madella &Lancelotti, 2023).

The deterioration in agricultural land quality poses a significant threat to crop productivity. An important constraint contributing to low crop productivity is soil infertility,resulting from nutrient deficiency, low organic matter, moisture stress, and high erosion. Land degradation is a challenge to the agricultural sector in sub-Saharan African (SSA) countries. Depreciation in land may result from immediate and underlying causes. Adetomiwa,Adekunle, Oluwatoba, and Oluwatosin (2024) identified biophysical factors, topography, climatic conditions, and poor land management techniques as the immediate causes of low crop productivity. Underlying causes to land depreciation wereidentified to consist of population expansion, land tenure, socioeconomic as well as appropriate policy variables (Ani, Anyika& Mutambara, 2022).

A report by the United Nations (2021) shows that Africa loses approximately 4 million hectares of forest land every year. This lost land is evidenced by the overuse of land, leading to degradation. Land degradation negatively impacts crop productivity, which serves as a source of livelihood. Increased population pressure on land use has aggravated land degradation in Nigeria, resulting in poor farm yields (Aminu&Jaiyeoba, 2015). Land degradation affects land in the country, where in some places, erosion wastes over 10% of the total land mass (Adedapo *et al*., 2020). Other factors, in addition to high population growth, contributing to increased land depreciation are inadequate policy on land management incentives and knowledge deficit on environmental degradation and climate change (Olarinre, Oladeebo&Olarinde, (2019).

With the need to improve livelihoods, small-scale farmers are compelled to either cultivate marginal soils or exploit forest areas, thereby increasing the effects of land degradation (Touch, Tan, Cook, Liu, Cross, Tran, Utomo, Yous, Grunbuhel, & Cowie, 2024). The attempt to address the causes of land degradation has been a challenge, given that the farmers operate mainly at a subsistence level. Given that the population of Nigeria is dependent on agriculture for livelihood, sustainable land management is of critical importance. The reason for the attached importance is to increase the productivity and capacity of the natural resource. Proper land management practices maximize the benefits of land while improving the natural land resources. An efficient land management practice prevents the negative effects of climate change (Altieri & Nicholls, 2017), particularly for small-scale farmers, and leads to improvement in productivity.

Small-scale farms refer to land holdings with less than five hectares in size (Alie, Abdul, Edward& Richard, (2019). Such small land holdings are also referred to as family, small-scale, resource-poor, subsistence, or low-income farms. In Africa, small-scale farming systems are diverse given the diverse nature of Africa's geography, agroecology, socio-economics, and demography.Any variation in farm output occasioned by decreased land fertility may imply that unsustainable land management strategies adopted by farmers play a part (Emmanuel, 2023). In the case of Jigawa State of Nigeria, where sorghum farmers are predominantly smallholders, there is a need to adopt appropriate farming practices to improve yield while maintaining land quality. However, the sustainable application of land management practices by small-scale farmers appears to be limited in the study area, given the socioeconomic limitations as well as institutional limitations (Adimassu, Langan, & Johnston, (2016). This study aims to assess the extent of adoption of land management as well as challenges encountered. Results from the study will contribute to information and policy formulation on sustainable land management

## Research Methodology

### The study area

The study was carried out in Jigawa State of Nigeria. The State is located in the northwestern part of Nigeria between latitudes $11^0$ N and $13^0$N and longitudes $8^0$ E and $10.15^0$E. The State shares borders with Kano State, Bauchi State, Yobe State, and the Zinder Region in the Republic of Niger to the north (Figure 1).

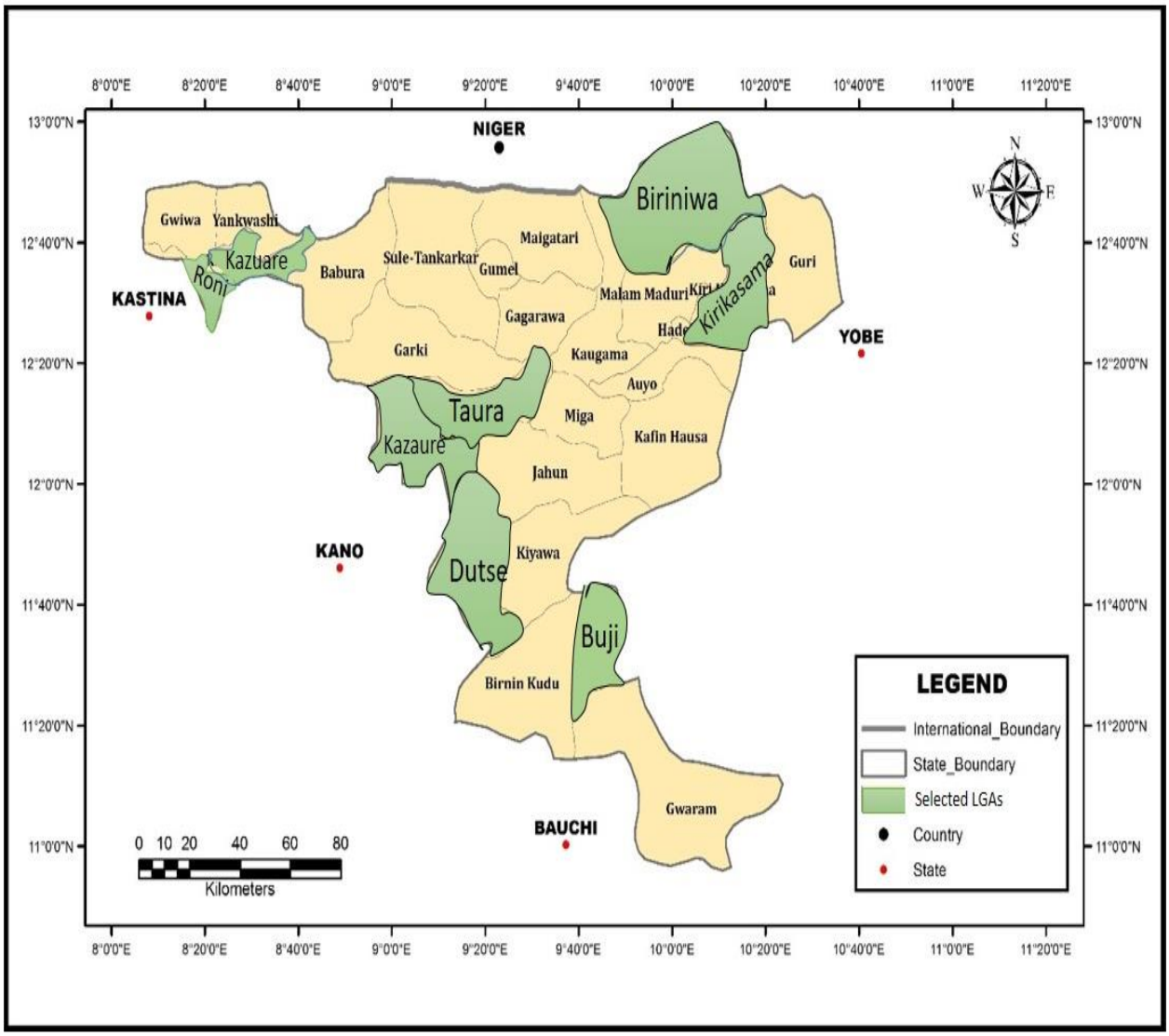


***Figure 1: Map of Jigawa State***

Jigawa State is known for its diverse climate as well as unique weather patterns. The State is characterized by three climate zones: the Sahel, Sudan Savannah, and Guinea Savannah zones. The Sahel zone dominates the northern part of the State with a semi-arid climate as the major characteristic. The northern region experiences a hot, dry, and partly dusty weather pattern for most of the year. According to Shugaba& Ahmed (2019), the average temperature for the State ranges from 30°C to 45°C during the day. The nights are cooler, with a temperature range of 15°C to 25°C. The rainfall pattern in the Sahel zone of the State is limited, given that it occurs between June and September. The average annual rainfall in the state is from about 300 mm to 500 mm. The dry season extends from October to May, and is dominated by the harmattan winds, which blow from the Sahara Desert, and are laden with dust and dry weather conditions. The population of Jigawa State is engaged in subsistence farming, while trade and commercial activities are undertaken on a small and medium scale. The State has an expanse of grazing land suitable for livestock production. The environment is conducive for different species of livestock production, such as cattle, sheep, goats, rabbits, donkeys, horses, and poultry (Shugaba& Ahmed, 2019). Crops grown in Jigawa State include millet, rice, sorghum,

maize, cowpea, groundnut, watermelon, tomato, soya bean, sesame, and tree crops (mangoes, cashews, date palms, and *Tamarindus indica* - Tamarind tree). Other economic activities are blacksmithing, leather making, tailoring services, auto repairs, metal works, carpentry, tanning, dyeing, food processing, and masonry.The State is inhabited by theHuasa/Fulani, the Kanuri found in Hadejia Emirate, and Badawa found in the northeastern parts of the state.

## Sampling Procedure and Sample Size

A multi-stage sampling procedure was used to select respondents for this study. The first stage involved a purposive selection of two Local Government Areas (LGAs) from each of thefouragroecological zones of the State based on the concentration of sorghum farmers. The second stage involved the purposive selection of 2 villages from each of the selected LGAs. In the third stage and following the approach of Orifah, Sani, Murtala& Ibrahim, (2021), the Raosoft sample size online calculator was used to determine the sample size of the study with an error margin of 5%, a confidence level of 95%, applied on a sample population of 643. This gave a sample size of 241, as shown in Table 1. The sample size was distributed amongst the villages proportionately to the sample frame.Data for the study were obtained from primary sources and related information on farming activities.

**Table 1: Sample size and sampling frame**

| Agric Zones | LGAs | Villages | Sampling frame | Sample size |
|---|---|---|---|---|
| Zone I | Dutse | Dutse | 53 | 20 |
| | | Chamo | 43 | 16 |
| | Kiyawa | Andaza | 45 | 17 |
| | | Katanga | 30 | 11 |
| Zone II | Gumel | Danfarantama | 38 | 14 |
| | | Maidabara | 46 | 18 |
| | Ringim | Ringim | 50 | 19 |
| | | Zangon Kanya | 37 | 14 |
| Zone III | Kazaure | Farundaba | 30 | 11 |
| | | Gada | 33 | 12 |
| | Roni | Kagadama | 30 | 10 |
| | | Dansure | 42 | 16 |
| Zone IV | Hadejia | Guducin | 44 | 17 |
| | | Bariki | 48 | 18 |
| | Kirikasam | Kirikasama | 34 | 13 |
| | | Tarabu | 40 | 15 |
| Total | 8 | 16 | 643 | 241 |

**Source**: Author's computation, 2023

Data was collected byaninterview schedule with the aid of a semi-structured questionnaire. Data collected included: the socioeconomic characteristics of farmers, and variables related to the adoption of land management practices of the farmers.

## Method of Data Analysis

Data for the study were analyzed using descriptive and inferential statistical tools. Descriptive statistical tools such as frequency counts, mean, and percentages were used to describe the socioeconomic characteristics of the farmers. The binary logistics model was used to estimate the factors influencing the adoption of land management practices among sorghum farmers.

## Binary Logistic Regression Model

Binary logistic regression is used when the dependent variable is dichotomous, coded 0 or 1 (Ullah, Shah, Ali, Naz, Mahar & Kalhoro, 2015). The advantage of the model is that the probabilities are bound between 1 and 0.

Logistic regression is applied if a given set of variables influences the adoption or non-adoption of land management practices. Binary logistic regression (equation i) tests the influence of the hypothesized explanatory factors on the dependent variable following the approach of Obisesan& Weli (2019). The choice for the adoption of land management activities for this study is expressed in the empirical form as;

$Y_i = X_i'\beta + \mu_i$……(equation i)

Where $Y_i$is 1 if the i$^{th}$ farmers adopt land management practices and 0 if otherwise. $X_i$represent theexplanatoryofi$^{th}$ variables; $\beta$ = the parameter estimates; $\mu_i$= the stochastic error term of the i$^{th}$ farmer, assumed to be independently and identically distributed (iid) with mean = 0 and variance = $\delta^2$. The explicit form of the model is presented in equation (ii) as,

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \mu_i$$

(equation ii)

Where, $X_1$ = age of household head (years) $X_2$ = Farm size (hectares), $X_3$ = Extension visits (number of times visited by extension agents), $X_4$ =Plot numbers (number of plots owned by the farmer),$X_5$ = household size (number of residents within a household), $X_6$ = cooperative membership (member=1, 0=otherwise), $X_7$ = farming experience (number of years as a farmer), $X_8$ = education (years in formal educational institution), $\mu_i$ = the error term

## Results and Discussion

### Socio-economic Characteristics of the Farmers

The results on the socioeconomic characteristics are presented in Table 2.

**Table 2: Socioeconomic characteristics of the farmers (n=241)**

| | | | |
|---|---|---|---|
| **Age (years)** | | | 39.1 |
| <24 – 38.3 | 127 | 52.7 | |
| 38.4 – 52.7 | 95 | 39.4 | |
| 52.8 – 67.1> | 19 | 7.9 | |
| **Sex** | | | |
| Male | 237 | 98.3 | |
| Female | 4 | 1.7 | |
| **Marital status** | | | |
| Married | 232 | 96.3 | |
| Single | 9 | 3.7 | |
| **Household-size** | | | 8.2 |
| <6 – 9 | 235 | 97.5 | |
| 10 – 13.1 | 6 | 2.5 | |
| **Level of education** | | | |
| No formal education | 21 | 8.7 | |
| Islamic education | 24 | 10.0 | |
| Primary school | 116 | 48.1 | |
| Secondary education | 56 | 23.2 | |
| Tertiary | 24 | 10.0 | |
| **Cooperative member** | | | |
| Member | 174 | 72.2 | |
| Non-member | 67 | 27.8 | |
| **Farming experience (years)** | | | 8.1 |
| <3 – 10.3 | 194 | 80.1 | |
| 10.4 – 17.7 | 30 | 12.0 | |
| 17.8 – 25.1> | 17 | 7.9 | |
| **Farm size (hectares)** | | | 1.6 |
| **<0.5 – 2** | 176 | 73.0 | |
| **2.1 – 3.5** | 65 | 27.0 | |

**Source**: Field survey, 2024

Survey results revealed that 52.7% of respondents were between 24 to 38 years. Results further revealed that 39.4% were aged between 39 to 52 years, while 7.9% were aged between 53 to 67 years. The average age of the farmers was approximately 39 years. Thus, sorghum farmers in Jigawa State can be characterized as predominantly middle-aged. Concerning the distribution of farmers based on sex, the majority were male (98.3%), while female farmers made up 1.7% of the sampled population. The results are evident, given that the culture in the State does not allow women on the field without being accompanied by males. As a result, women are more involved in sorghum processing in their homes. These results are in line with the findings of Quisumbing, Heckert, Faas, Ramani, Raghunathan, Malapit, & Study Team (2021), who observed that the processing of agricultural produce is typically carried out by women to provide additional income.

Marital status is the source of family labour, the results showed that 96.3% of the farmers were married, while 3.7% were single. The results emphasize the importance of family labour in sorghum production. Results for household size show that 97.5% had between 6 and 9 members, 2.5% had 10-13 members as household size. The mean household size was 8 persons. This emphasized the importance of family labour to meet family demands. Such families may adopt land management practices.

About 8.7% had no formal education, 10% attained Islamic education, 48% attained primary education, 23.2% attained secondary education, while 10% attained tertiary education. The results show that most of the farmers attained formal education and can read and use new technology. Analysis of cooperative membership showed that 72% of sorghum farmers belonged to cooperative societies, while 27.8% did not belong to any group. This may be explained by the availability of government programs developed to assist the farmers.

On experience, about 80% interviewed farmers had been into sorghum production for 3 to 10 years. Another 12% had produced the crop for 11 to 18 years. On average, the respondents had been producing sorghum for about 8 years. This shows that the farmers were experienced in sorghum production. Results on farm size show that 73% of the farmers had farm sizes between 2.2 hectares to 3.5 hectares, while 27% had farm sizes between 2.1 to 3.5 hectares, with an average farm size of 1.6 hectares. This result is an indication that farmers in the study area were small-scale farmers. The results are in line with the findings of Wondimu, Jema, Mengistu, &Bezabih (2020) that a large farm size is necessary for land management, given that it is suitable for various forms of land management practices. This means that inadequate land area may pose a limitation in the adoption of land management practices.

## Land Management Practice in the Study Area

The different land management practices in Jigawa State are presented in Table 3. About 49.4% of the farmers believe that inorganic fertilizer application is the major approach to sustained sorghum production. This may explain the wide application of fertilizers by the farmers, though in varying quantities. Inorganic application was also perceived to be an important approach in sorghum production. Many farmers perceive that inorganic application before the rains and after plating helps to preserve soil from leaching, thereby increasing yield. Manure in Jigawa is a combination of animal waste and the burn residue of organic waste, usually applied before the farm is ploughed. About 8.3% of the farmers practice crop rotation as a dominant land management practice. This approach makes use of different rooting systems and individual crop requirements to give high yields and maintain soil fertility.

Agroforestry practiceswere followedby6.6% offarmers used this approach. Various economic trees are planted in the farmland. Apart from land conservation purposes, such tree parts may

be harvested for use in various ways. The benefits of agroforestry may be long-lasting. Table 3 further revealed that 11.6% ofrespondents perceived that crop rotation helped to increase yield while preserving the soil structure. Irrigation was practiced as the major land management practice by 5.4% of the respondents. The high cost of irrigation may be the reason why it is practiced by a few farmers. However, yield from this land management approach is usually high, given that other factors are not limiting yield performance.

Micro-basin was practiced by 3.3% of the respondents. It involves preparing small basins to retain some run-off. This provides ample time for crop roots to make use of water trapped in the micro-basins. Some crops may be planted in the basin, or the basin holds only water that is gradually released into the farm. Crop residue was practiced by 6.6% of the farmers. This was explained in terms of the use of residue as animal feed and for building purposes. Given the different uses, some farmers harvest and sell the residue. Those used for land management purposes were due to the long market-to-farmer distance, which makes it less economical to bring the waste to the market. The adoption of each depended on the ease of application in terms of cost and ease of application.

**Table 3: Different Land Management Practices**

| S/N | land management practices | Frequency | Percentage |
|---|---|---|---|
| 1 | Manure application | 62 | 25.8 |
| 2 | Crop rotation | 20 | 8.3 |
| 3 | Irrigation | 13 | 5.4 |
| 4 | Fertilizer application | 116 | 48.1 |
| 5 | Micro-basin | 8 | 3.3 |
| 6 | Crop residue | 6 | 2.5 |
| 7 | Agroforestry practices | 16 | 6.6 |
| | **Total** | **241** | **100** |

**Source:** Field survey 2024

## Factors Influencing Land Management Practices by Sorghum Farmers

Table 4 shows the binary logistic regression carried out to examine the factors influencing the adoption of soil management practices by sorghum farmers. The results showed that the values of $R^2N$ ($R^2$Nagelkerke) of 0.737 are attributed to the independent variables. The fitness of the model was further confirmed by the chi-square ($\chi^2$) value of 86.1 (P<0.01). The variables that significantly influenced the adoption of land management practices were age, farm size, plot size, number of farm plots, household size, and education.

The coefficient for the variable age is $\beta_1 = 0.235$, which is positive. This means that an increase in age is associated with an increase in the probability that the dependent variable is "adopted". The statistical assistant level of significance ata 1% (P< 0.01) level indicates that this influence is significant. The odds ratio of 1.037 indicates that a one-unit increase in the variable age will increase the odds that the dependent variable is adopted 1.037 times. The resultsareexpected, given that older farmers have more experience in indigenous land management practices. Amoussohoui, Arouna, Bavorova, Verner, Yergo&Banout(2023),in theirstudy of factors influencing the adoption of digital extension services,had similar results and opined that older farmers have a high reception of new technology.

The coefficient for the variable farm size is $\beta_2 = 0.651$ (which is positive). This means that an increase in farm size is associated with an increase in the probability that the dependent variable is "adopted". The level of significance at 1% (P<0.01) indicates that this influence is significant. The odds ratio of 1.850 indicates that a one-unit increase in farm size will increase the

odds that the dependent variable is adopted 1.850 times. Farmers with large farmland produce more sorghum for sale and earn adequate farm income, and may be interested in land and soil conservation practices.Douglas (2018) observed that farm size had a positive and significant influence on technology adoption.Additionally, the acquisition of large-scale farms guarantees economies of scale.

The coefficient for the variable number of plots was $\beta_4 = -0.342$,meaning that it was negative. This implies that an increase in the number of plots is associated with a decrease in the probability that the dependent variable is "adopted". The statistical level of significance at 5% (P<0.05) indicates that the influence was significant. The odds ratio of 0.952 indicates that a one-unit increase in the variable, number of plots, will decrease the odds that the dependent variable is adopted 0.952 times. An increase in plots will increase the cost of land management practices. Nguyen and Nguyen (2021) had similar results and concluded that the variable significantly affects the probability of adopting modern agricultural technology.

The coefficient for household size was $\beta_5 = 0.408$, showing that itwas positive.The implication is that an increase in household size is associated with anincrease in the probability that the dependent variable is "adopted". The statistical level of significance at 1% (P<0.01) indicates that the influence was significant. The odds ratio of 1.163shows that a one-unit increase in the variable, household size, will increase the odds that the dependent variable is adopted1.163times.Oyetunde-Usman, Olagunju, &Ogunpaimo(2021) had similar results and explained in terms of the availability of labour in households with large household sizes.

**Table 4: Regression results for factors influencing land management practices**

| Predictor | Coefficients | Lower | Upper | SE | Z | Odds ratio |
|---|---|---|---|---|---|---|
| **Intercept** | -5.019 | -11.784 | 1.779 | 0.459 | -10.935 | 0.007 |
| **Age** | 0.235* | -0.042 | 0.115 | 0.045 | 5.222 | 1.037 |
| **Farm size** | 0.651* | -0.215 | 1.445 | 0.213 | 3.056 | 1.850 |
| **Extension visits** | -0.063 | -1.309 | 1.175 | 0.633 | -0.100 | 0.935 |
| **Plot numbers** | -0.342** | -0.691 | 0.592 | 0.127 | -2.693 | 0.952 |
| **Household size** | 0.408* | -0.103 | 0.405 | 0.129 | 3.163 | 1.163 |
| **Cooperative member** | 1.217 | 0.143 | 2.700 | 0.652 | 1.867 | 0.144 |
| **Experience** | 0.125 | -0.084 | 0.109 | 0.249 | 0.502 | 1.013 |
| **Education:** | | | | | | |
| Tertiary– Primary | 0.657* | -1.642 | 3.033 | 0.192 | 3.422 | 1.005 |
| Secondary–Primary | 0.671** | -1.214 | 2.172 | 0.263 | 2.551 | 1.615 |
| No education–Primary | 0.149 | -2.258 | 2.567 | 1.232 | 0.121 | 1.168 |
| **$R^2N$** | 0.737 | | | | | |
| $\chi^2$ | 86.6* | | | | | |

**Source:** Field survey, 2024; *, ** shows significance at 1 % and 5% levels, respectively.

Thecoefficient for secondary education was positive (0.671) and significant at a 5% (p<0.05) level.The coefficient for tertiary education was 0.657 was positive and significant at the 1% (P<0.01) level. The odds ratios of 1.615 and 1.005 showthat a one-unit increase in the variable, secondary and tertiary education, respectively,will increase the odds that the dependent variable, island management practices, are adopted by 1.115 and 1.005times, respectively.Using the odds of land management practices among illiterate farmers as a reference, farmers with better educational attainmenthave a higher chance of adopting land management practices. The positive and significant association between farmers' educational status and land management practices is consistent with the initial *a priori* expectation, given that an educated household head understands better the benefits of land management practices. Nguyen and Nguyen (2021) observed that educational status influenced farmers' decisions to use water conservation structures.

## Challenges faced by farmers in adopting land management practices

Table 5 shows the challenges faced by sorghum farmers in adopting and implementing land management practices. Inadequate supply and high cost of fertilizer (48%) were identified as a major challenge faced by the farmers. Adedapo, Awobona, Ijah, Bolaji & Emmanuel (2020) in their study on sustainable land management practices among food crop farmers in the northern guinea savanna of Kaduna State had similar results and opined that it may be as a result of widespread need for the input. Where manure (12 %) was used, the scarcity of the product and the high cost limited its use. In addition, the high production cost of inputs (10 %) posed a major challenge. Touch*et al*. (2024) had similar results and recommended the use of locally available raw materials. Another challenge identified is access to improved seeds (8%). The improved seeds, when available, were mostly in urban areas, while farming was in rural areas. Low sorghum (7%) seed availability was identified as a major challenge by the respondents. Other challenges were posed by poor transport infrastructure (6%), low access to credit (5%), and, where present, farmers do not have the required collateral and poor developed distance to market roads (4%).Balana&Oyeyemi(2021)in a study on constraints to agricultural credit in smallholder farming in developing countries observed that access to credit was a major challenge and recommended more studies to identify the method to solve this challenge

**Table 5: Challenges faced by farmers in sorghum production**

| S/N0 | Constraints on the use of land management practices | Frequency | Percentage |
|---|---|---|---|
| 1 | High cost and inadequate supply of fertilizer | 116 | 48 |
| 2 | Low access to manure and organic waste | 29 | 12 |
| 3 | High production cost of inputs | 24 | 10 |
| 4 | Low availability of improved sorghum varieties | 19 | 8 |
| 5 | Inadequate supply of sorghum seeds | 17 | 7 |
| 6 | Poor transport infrastructure | 14 | 6 |
| 7 | Non-availability of credit for land management practices | 12 | 5 |
| 8 | Poorly developed distance to market roads | 10 | 4 |
| | **Total** | **241** | **100** |

**Source:** Field survey, 2024

## Conclusion

This study examined factors that influence the adoption of land management practices.Results from the study revealed that the respondents were youthful, mostly male, married,and highly experiencedin land management practices for 8 years.The majority of the respondents belong to agricultural input cooperatives. Detailed analysis revealed that the farming population was youthful, whichpositively influenced sustainable land use.Educational status revealed that most farmers attained formal education, which meant they had adequate information on the benefits and challenges of land management practices.Common land management practices identified in the study area were the use of fertilizer, crop rotation, and irrigation approaches.Adoption of land management practices were significantly influenced byage, farm size, number of plots, household size, and level of education, However, high production costs, scarcity of improved sorghum seeds, poor transportation infrastructure, low seeds availability, long distance to the nearest market and poor roads infrastructure negativelyaffect the adoption of land management practices.

## Recommendations

(i) Policies and programsshould be put in place by the government, farmers' groups, and development partners to encourage the youthful population of farmers on innovative land management practices as well as innovative sorghum production techniques.

(ii) Farmers should be encouraged to use labour-saving, sustainable, and innovative tillage approaches in sorghum production, like manual and mechanical tillage, as well as

micro-basin development,which will improve production.

(iii) Education on land management and crop production should beupgraded and strengthenedto provide practical knowledge to the farmers.

(iv) Policy should be put in placeto facilitate access to larger-sized farms,which will encourage sustainable land-use practices.

(v) Farmers should be taught sustainable approaches to preserve seed for subsequent seasons to ensure an adequate supply.

(vi) General policy on infrastructural development,especially the road network, will facilitate the transportation of equipment and inputs fromthe market to farms.

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