



Socio-Economic Characteristics and Constraints Analysis of Acha (*Digitaria exilis*) Production in Kaduna State, Nigeria

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ABSTRACT

This study explores the socioeconomic background of acha (*Digitaria exilis*) farmers and the major constraints affecting acha production in Kaduna State, Nigeria. Acha, also known as hungry rice, is increasingly recognized as an important indigenous cereal because of its nutritional benefits, adaptability to harsh conditions, and potential to support food security and rural incomes. In spite of this, there is still limited empirical research on the production conditions and challenges faced by its farmers, particularly in northern Nigeria. To address this gap, the study adopted a multi-stage sampling technique to select 286 farmers from a total population of 1,107 acha producers. Data were collected using structured questionnaires and analyzed with descriptive statistics and Kendall's Coefficient of Concordance. The findings indicate that acha production in the study area is mainly carried out by smallholder farmers who operate with limited productive resources and weak institutional support. Many of the farmers had poor access to credit (88.1%), improved farm inputs (71.0%), and agricultural advisory services, all of which affect their production capacity. The study also found that the most serious production constraints were inadequate extension services (62.6%), high cost of inputs (89.2%), poor access to credit (89.5%), and pests and diseases (5.6%). These challenges continue to reduce productivity, limit efficiency, and prevent the expansion of acha production beyond small-scale subsistence farming. The study therefore highlights the need for more effective extension support, improved access to finance and inputs, and stronger pest and disease control measures. Addressing these issues would not only improve acha production but also strengthen the livelihoods of farming households in Kaduna State.

Keywords: *Digitaria exilis* (Acha), Kendall's Coefficient, Smallholder farmers, Farm input, Kaduna State

INTRODUCTION

Hungry rice millets, belonging to the plant family Poaceae, are vital cereal crops in West Africa with significant cultural, nutritional, and economic value. The two cultivated species are *Digitaria exilis* Stapf (white fonio or hungry rice) and *Digitaria iburua* Stapf (black fonio) (Elangovan *et al.*, 2023). Global food systems face unprecedented challenges from rising demand, climate change,

biodiversity loss, and food insecurity (FAO, 2023). With the global population projected to require 70% more food by 2050, sustainable agricultural practices are critical. This is especially urgent in Sub-Saharan Africa (SSA), a region characterized by rain-fed, smallholder farming systems that is highly vulnerable to environmental and economic

shocks (Lowder *et al.*, 2016; FAO *et al.*, 2024).

In this context, agricultural biodiversity (agro-biodiversity) is recognized as a cornerstone for building resilient and adaptive food systems (FAO, 2019; Mockshell and Villarino, 2023). However, the 20th-century thrust toward agricultural intensification led to a significant decline in crop diversity, creating overreliance on a handful of major staples and increasing systemic vulnerability (Beal *et al.*, 2017; Khoury *et al.*, 2022). Neglected and Underutilized Species (NUS), like hungry rice, represent crucial genetic resources. These species are often resilient, nutritionally dense, and culturally important, yet they remain under-researched and underfunded despite their potential to enhance food security and sustainability (Hunter *et al.*, 2019; Ulian *et al.*, 2022). Africa is the world's second-largest producer of cereals. Within this sector, hungry rice is a small-grained but crucial crop for smallholder farmers in arid and semi-arid regions (Animasaun *et al.*, 2018). Nigeria is a major producer, with cultivated area and production showing consistent growth, though yields have fluctuated (FAOSTAT, 2023). The crop is celebrated for its exceptionally short growth cycle earning it the name "hungry rice" in regions like North Central Nigeria and its ability to thrive in poor soils with minimal inputs (Durairaj *et al.*, 2019; Enyiukwu and Bassey, 2020). Nutritionally, hungry rice is gluten-free, rich in essential amino acids, vitamins, and minerals, making it valuable for addressing malnutrition and catering to specialized diets (Deriu *et al.*, 2022).

Despite its low agronomic yield and challenges in processing, growing market interest in traditional, nutritious foods is revitalizing its value chain (Cruz, 2016; Kanlindogbè *et al.*, 2020). Previous studies have focused more on agronomic practices than on the comprehensive economic analysis including profitability and efficiency necessary to inform farmers and policymakers (Aggarwal *et al.*, 2022). This gap in knowledge hinders the development of strategies to integrate hungry rice into

sustainable farming systems. Therefore, this study seeks to address the following objective. Describe the socioeconomic characteristics of hungry rice farmers and describe the constraints encountered by hungry rice producers and marketers. Ultimately, the findings will benefit a wide range of stakeholders, including farmers, researchers, investors, and development agencies, guiding efforts to transform hungry rice from a neglected crop into a pillar of sustainable agricultural development in Nigeria.

METHODOLOGY

Study Area

The research was carried out in Kaduna State where hungry rice production as an old history because of the vegetation and water availability. The state lies between latitudes 09° 02' North and 11° 32' North of the equator and 06° 15' and 08° 50' East of the prime meridian. It shares borders with Abuja in the south-east, Katsina, Kano, and Zamfara in the North, Nasarawa and Plateau in the north-east, Niger in the north-west, and Bauchi in the south-west of the state (Sani *et al.*, 2021). The state makes up almost 5% of Nigeria's total land area, or 923,768 square kilometers, with an area of 46,016 square kilometers, and 23 local government areas in the state. In 2006, the population was estimated to be 6,066,562 (NPC, 2006). Based on this number, the state's current estimated population at the 3.2 percent national population growth rate is 7,037,153, with 606,007 farm households making up the majority of the population (KADP, 2023). The vegetation of the state is divided into Northern Guinea Savanna in the north and Southern Guinea Savanna in the south (Olomode, 2002). Soils are a mixture of fine sand and clay, which have been described as sandy loam in nature. The climate varies from the northern to the southern parts of the state. Mean annual temperature across the region is 27 °C, and mean annual humidity is between 50 and 60%, increasing to occasionally > 80% in the rainy season (Dalil *et al.* 2015). The wet season usually lasts for about six months

(May–October), with great variation as one move northward. At 1,524 mm on average, the southern section of the state receives

significantly more rainfall than the extreme northern part, which receives only 1,016 mm on average (Mignouna et al., 2013).



Figure 1: Map of the Study Area

Source: Google Map (2026)

Sampling techniques

The study employed a multi-stage sampling technique for the selection of the hungry rice farmers in the state. The first stage involved the purposeful selection of three Local Government Areas (Jama'a, Kaura, and Sanga) out of 23 Local Government Areas in the Kaduna state, the selection was based on the concentration of hungry rice production. The second stage involved purposive selection of 12 communities (four each from this Local Government Area) based on the

prominence of hungry rice production and accessibility of the farmers. The third stage involved the proportional random sampling of the population distribution of each farmer in the study area and was estimated to be 1107, and thus the sample size of 286 farmers will further be estimated at a 95% Confidence level using Raosoft Calculator. The list of hungry rice farmers was obtained from NBS (2025). Table 1 displays the sampling frame and size used in this investigation.

Table 1: Summary of Sampling Frame and Sample Size of Hungry Rice Producers

LGA	Communities	Sampling Frame	Sample Size
Jemaa	Godo-godo,	78	20
	Nissama,	67	17
	Dogo-fili	82	21
	Gida Waya	75	19
Kaura	Mancho,	80	21
	Kaura	86	22
	Kagoro	69	18
	Gizaquw	73	19
Sanga	Amari,	132	34
	Wate,	120	31
	Agamite	115	30
	Sambe	130	34
Total		1107	286

Source: KADP Survey (2023)

Data Collection and Analysis

Primary data was used for the study. An oral interview was used in conjunction with a standardized questionnaire to gather data based on the farming season. A quantitative interview with a key informant in the hungry rice production areas will also be conducted using the checklist.

Descriptive statistics these include measures of central tendencies such as mean, median and mode, frequency and percentages. This was used to determine the socioeconomic characteristics of ACHA farmers while Kendall's coefficient of concordance was used to analyze the constraint of Acha production in the study area.

Kendall's Coefficient of Concordance

Kendall's W statistic (sometimes called the *Coefficient of Concordance*) is a non-parametric statistic used to assess agreement between different raters, and ranges from 0 to 1. Zero is no agreement at all between raters, while 1 is perfect agreement. The statistic is calculated either on an interval scale or on an ordinal scale. For example, let's say a group of workers were asked to rank a list of workplace concerns from least important to most important.

If the W Statistic is 0, that means everyone ranked the list differently (or randomly).

If the W Statistic is 1, then everyone ranked the list in exactly the same order.

W statistic should only be used for measuring concordance between variables that are measuring the same general properties of objects. For example, if negative and positive correlations are of equal importance, this would not be a suitable test. W is the notion used if the statistic is from a population. W is the notion for the sample statistic

Formula: the formula for W statistic is

$$W = \frac{12S}{m^2(n^3 - n)} \quad 1$$

Where:

S = the sum of squared deviations,
 m = the number of judges (raters),
 n = the total number of objects being ranked.

A Second formula can also be used that gives the same results,

$$W = \frac{12S1 - 3m2n(n+1)2}{m^2(n^3 - n) - MT} \quad 2$$

Where:

T = is the correction factor for tied ranks.

RESULTS AND DISCUSSION

The mean age of sampled acha farmers was 47 years, with 74.5% falling within the economically active range of 35–49 years (Table 2). This aligns with FAO (2024) benchmarks and reflects the demographics' capacity for innovation and resilience in farming (Fakoya & Daramola, 2021). Younger farmers (35–49 years) are better equipped to adopt new techniques and endure physical demands, corroborating findings by Ahmed et al. (2025). The study revealed that most farmers (67.4%) had households of 6–10 members, averaging 6 persons. This comprised of the head, the wife/wives, children and other dependents that live in the same house. Larger households contribute family labor, reducing reliance on hired workers a trend consistent with Ahmed et al. (2025). However, high dependency ratios may strain resources.

This is an important factor that determines both the production level and efficiency of farming activities. The distribution of acha farmers by farming experience in (Table 2) showed that the mean years of farming experience was found to be 18 years and majority of the acha farmers (82.9%) have been in acha production between 11–20 year. Experience enhances managerial efficiency, as noted by Mbanasor and Kali (2022) and Obasre et al. (2025), that years of farming experience has a positive and significant relationship with a farmer's economic efficiency.

The distribution of acha farmers in table 2 showed that majority of the acha farmers (78.5%) cultivated between 0.20–1.90 hectares. The mean farm size was 1.085 hectare this implied that acha farmers in the study area were predominantly small-scale farmers. This aligns with Ibrahim's (2024) classification of smallholders as those farming less or equal to 2 hectares.

Table 2: Quantitative Analysis of Socioeconomic Characteristic of Acha Famers

Variable	Frequency	Percentage %	Mean	Min	Max.	S. D.
Age						
35-39	9	3.1	47.64	35	62	4.081
40-44	49	17.0				
45-49	156	54.4				
50-54	56	19.5				
55-59	9	3.1				
60-64	7	2.4				
Household size						
1-5	89	31.1	6.39	3	16	1.468
6-10	193	67.4				
11-15	3	1.0				
16-20	1	0.3				
Farm Experience						
6-10	19	6.6	18.35	6	35	4.559
11-15	78	27.3				
16-20	159	55.6				
21-25	18	6.3				
26-30	11	3.8				
31-35	1	0.3				
Farm size (ha)						
0.20-0.76	54	18.8	1.085	0.2	3.00	0.5164
0.77-1.33	169	50.0				
1.34-1.90	28	9.7				
1.91-2.47	27	9.4				
2.48-3.04	9	3.1				

Source: Field Survey (2025)

Quantitative Analysis of Socioeconomic Characteristic of Acha Famers

Gender is an important factor to consider in farming activities or any other activity that demands energy. The results of gender distribution in table 3 revealed that 70.6 % respondents were males while 29.4% were females. This indicated that acha production was basically male-dominated and the reason could be related to the nature of farm work as much energy. Similar gender disparities were reported by Ahmed et al. (2025). The results in table 3 showed that and 99.0% of the respondents were married while 1.0% was widow. This finding suggested that acha farmer in the study area is largely practiced by individual with established family structures. Studies have shown that marital status plays a vital role in agricultural operation. This is line with (Food and Agriculture Organisation, 2022). The

result in table 3 also showed that majority of the acha farmers (78.3%) had secondary education, 16.4% had tertiary education, and those who had primary and adult education were 2.8%, and 2.4% respectively. This indicated that all acha farmers sampled in the study area are literate. Thus, literacy level will greatly influence the decision making and adoption of innovation by farmers, which may bring about increase in efficiency and productivity. This is in line with the findings of Ogunremi (2025) who reported that education fosters innovation adoption. The result further reveals that the majority of the farmers (68.9%) are members of cooperatives while the remaining 31.1% did not belong to any farmers' association. This implied the existence of adequate information sharing and assimilation for efficient and effective management of resources as regards acha production thereby influencing and facilitating

resource pooling and knowledge sharing critical for productivity (Ahmed et al., 2025). The results in table 3 showed that 71.0% of the farmers had do not have contacts with extension services while 29.0% had extension contact. This implies that majority of farmers (71.0%) had no access to information of the potential gain earned in adopting new technologies especially in acha production, which is capable enough to increase efficiency in

acha production. The result lastly showed majority of acha farmers (88.1%) of the respondents had no credit especially from external source; rather they relied on personal savings while 11.9% had credit especially from family and friends. This constrained of technological adoption the farmers relied on personal savings, hindering expansion (Adeyemi et al., 2025).

Table 3: Quantitative Analysis of Socioeconomic Characteristic of Acha Famers

Variable	Frequency	Percentage (%)
Gender		
Male	202	70.6
Female	84	29.4
Marital Status		
Married	283	99.0
Widow	3	1.0
Education		
Adult Education	7	2.4
Primary	8	2.8
Secondary	224	78.3
Tertiary	47	16.4
Cooperative Membership		
Member	197	68.9
Non-Member	89	31.1
Access to Extension		
No	203	71.0
Yes	83	29.0
Access to credit		
Access	34	11.9
No Access	252	88.1
Sources of Credit		
Personal saving	230	80.4
Money lender	34	11.9
Family and friends	22	7.7

Source: Field Survey (2025)

Production Constraint Encountered the Acha Farmers in the Study Area

The top constraints affecting production were low income (96.2%), lack of capital (89.5%), and high cost of inputs (89.2%). These findings align with Oluwatosin (2018), who noted financial constraints as major impediments to agricultural productivity in Nigeria. Similarly, Adebayo (2020) highlighted the crippling effect of high input costs on smallholder farmers. Analysis of constraints to acha production in the study areas revealed low income (96.2%), lack of capital (89.5%),

and high cost of inputs (89.2%) as the top three challenges. These findings align with Ojo (2019), who noted that financial constraints significantly impede acha production in Nigeria's Middle Belt. Similarly, Ahmed (2020) highlighted the crippling effect of high input costs on smallholder acha farmers in Kaduna State. The high Kendall's W value (0.94) indicates strong agreement among respondents on these constraints, suggesting policymakers should prioritize financial interventions and input subsidies to boost acha productivity in Kaduna State

(Nwosu, 2018 and also report by Nwankwo, (2019) who suggested policymakers should prioritize financial

interventions and input subsidies to boost productivity.

Table 4: Production Constraint Encountered the Acha Farmers in the Study Area

Variable	Frequency	Percentage %	Rank
Low soil fertility	275	96.2	1 st
Lack of Capital	256	89.5	2 nd
High cost of inputs	255	89.2	3 rd
Herdsman conflict	219	76.6	4 th
Poor extension	179	62.6	5 th
Low soil fertility	58	20.3	6 th
Small holder	20	7.0	7 th
Pest attack	16	5.6	8 th

Source: Field Survey (2025)

Marketing Constraint Encountered the Acha Farmers in the Study Area

Table 5 revealed the major constraints to acha marketing in the study areas are high cost of inputs (94%), lack of value added for acha production (83.6%), and milling challenges (80.8%). This indicates that marketers face significant production cost and processing issues. Limited market frequency (66%) is also a notable challenge. These findings suggest focusing on cost management and value addition could improve acha marketability Nwankwo, (2019). Kendall's $W \approx 0.92$ (indicates strong agreement among respondents). This suggests respondents strongly agree on these constraints. According to Siegel (2011), a high W value indicates consensus among raters.

The strong consensus (Kendall's $W \approx 0.92$) on acha marketing constraints highlights key areas for intervention. High input costs, lack of value addition, and milling issues are top concerns, suggesting policymakers should focus on financial support and processing infrastructure (Adebayo, 2018). These findings align with Ogunremi (2020), who noted that limited value addition reduces acha's market competitiveness in Nigeria. Adebayo (2018) also highlighted high input costs as a major constraint to acha production and marketing in the study areas. The strong presence of these constraints suggests marketers should prioritize value addition and cost management strategies.

Table 5: Marketing Constraint Encountered the Acha Farmers in the Study Area

Constraints	Frequency	Percentage	Ranking
High cost of inputs	270	94.0	1 st
Lack of value added	239	83.6	2 nd
Milling	231	80.8	3 rd
Limited market	190	66.0	4 th
High cost of labour	87	30.0	5 th
Preferences (aged people)	55	19.2	6 th

Source: Field Survey (2025)

CONCLUSION

This study concludes that while *acha* (*Digitaria exilis*) holds significant potential for enhancing food security and rural livelihoods in Kaduna State, its production remains trapped in a low-productivity, subsistence cycle due to systemic institutional and economic

constraints. The overwhelming lack of access to formal credit (88.1%), high input costs (89.2%), and the near-absence of effective extension services (62.6%) collectively hinders the capacity of smallholder farmers to transition into commercial-scale production. Furthermore, the reliance on traditional

farming methods with limited advisory support perpetuates inefficiencies that leave farmers vulnerable to pests and market fluctuations.

RECOMMENDATIONS

The study therefore recommends the need for more effective extension support, improved access to finance and inputs, and stronger pest and disease control measures. Addressing these issues would not only improve acha production but also strengthen the livelihoods of farming households in Kaduna State.

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