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Research Article

Economic Analysis of Wheat (*Triticum aestivum L.*) Production in Auyo Local Government Area of Jigawa State, Nigeria

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ABSTRACT

This study analyzed the economics of wheat (*Triticum aestivum L.*) production in Auyo Local Government Area of Jigawa State, Nigeria. A total of 164 wheat farmers were selected using multistage sampling. Primary data were collected through structured questionnaires and analyzed using descriptive statistics and cost - return analysis. The results revealed that the majority of respondents were male, aged 29-39 years, had secondary education, and had an average farm size of 0.97 hectares. Profitability analysis indicated a gross margin of ₦1,108,260.51 and a net farm income of ₦1,046,675.31 per hectare, with a return of ₦1.53 per naira invested. Major constraints identified include high fuel prices, high fertilizer costs, expensive irrigation facilities, untimely supply of subsidized inputs, transportation challenges, and pest and disease infestation. The study concludes that wheat production is a profitable enterprise despite prevailing production constraints. It recommends strengthening input subsidy programs, investing in irrigation infrastructure, improving access to credit, and enhancing extension service delivery to improve productivity and profitability.

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1 Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops globally, providing food and income for millions of people. It contributes significantly to global caloric and protein intake and plays a strategic role in food security, supplying about 20% of the world's dietary calories and protein and serving as a staple for a large proportion of the global population (Sharma et al., 2025). In Nigeria, wheat is predominantly cultivated in the northern region under irrigation systems along river basins and floodplains, where climatic conditions are relatively conducive. This is largely due to the semi-arid environment and low rainfall in northern Nigeria, which necessitate irrigation for optimal wheat production (Waziri et al., 2025). Domestic demand for wheat has increased considerably due to population growth, rapid urbanization, and changing dietary preferences. However, local production has not kept pace with demand, resulting in heavy reliance on imports. Nigeria remains one of the largest wheat importers in Sub-Saharan Africa (FAO, 2023; USDA, 2024).

Jigawa State is a leading producer of wheat in Nigeria, with wheat cultivation increasing significantly from 80,000 hectares in the 2023/2024 season to 105,000 hectares in the 2024/2025 season due to government and private-sector interventions (World Bank, 2025). The state's production growth is supported by government initiatives and partnerships with organizations like the Flour Milling Association of Nigeria (FMAN) and the African Development Bank. Keys to its strategy were providing subsidized inputs to farmers, offering training, and research grants, and improving agricultural infrastructure to boost productivity and advance food security goals. Therefore, an economic analysis of wheat production in Jigawa State is crucial for understanding the nature of the wheat enterprise, identifying opportunities and constraints, and developing strategies for improvement.

Wheat production contributes significantly to food security, employment generation, and income diversification in northern Nigeria, where irrigated wheat farming sustains rural livelihoods and enhances dry-season agricultural activities (FAO, 2023, and International Maize and Wheat Improvement Center, 2022). Despite its importance, rising production costs, limited access to improved inputs such as certified seeds and fertilizers, and infrastructural deficiencies, including inadequate irrigation facilities and poor rural transport networks, continue to constrain productivity and profitability among wheat farmers (Federal Ministry of Agriculture and Food Security, 2024).

In response, several policy initiatives, such as the National Wheat Development Programme and import substitution strategies, have been introduced to boost domestic production. However, farm-level economic performance data remain scarce in Jigawa State, limiting policymakers' and investors' ability to make informed, evidence-based decisions. This data gap constrains effective planning, efficient resource allocation, and targeted investment within the wheat value chain (National Bureau of Statistics [NBS], 2023).

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2 Materials and Methods

2.1 Study Area

The study is set in Auyo Local Government Area (LGA), Jigawa State, Nigeria, a key wheat-producing region in northern Nigeria. Auyo LGA lies within the Sudan savannah agro-ecological zone, characterized by a semi-arid climate, with annual rainfall ranging from 600–900 mm and temperatures averaging 28–38°C. The area is geographically located between approximately 11°27′N to 11°41′N latitude and 10°04′E to 10°22′E longitude. These conditions, coupled with proximity to the Hadejia Jama'are River Basin, make the area suitable for wheat production. The LGA covers about 600 km² and supports a predominantly agrarian population engaged in crop farming and livestock rearing. Wheat is cultivated mainly under smallholder irrigation schemes, with average farm sizes below 1 hectare, relying heavily on family labour. The distinct dry season provides favorable conditions for wheat cultivation, while water from the river system supports irrigation. Moderate access to inputs, cooperative groups, and extension services exists, although infrastructural challenges, limited mechanization, and high input costs persist. These characteristics make Auyo LGA ideal for studying wheat production, profitability, and constraints.

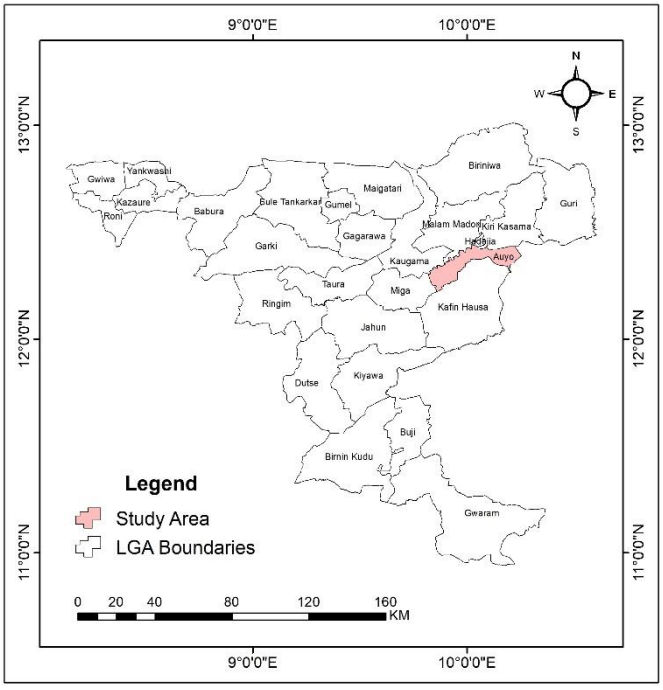

Figure 1: Study Area

2.2 Sampling Procedure

A multistage sampling technique was employed to select 164 respondents. First, purposive sampling was employed to select the Auyo Local Government Area for the study, as one of the key wheat-producing local governments in Jigawa State. The second stage involved a purposive sampling of six prominent wheat-producing communities in the local government. The third stage involves a random sampling of wheat farmers from the selected communities. Finally, the Raosoft Sample Size Calculator (Raosoft, 2004) was used to determine the sample size with a 5% margin of error and a 95% confidence level, yielding a total of 164 respondents. Bowley's proportion allocation formula was employed to establish the sample size for each community. The communities selected were Gamsarka, Ayama, Adaha, Auyo, Agumari, and Mado.

Bowley's proportion allocation formula is expressed as:

$$n_i = n\frac{N_i}{N} \quad (1)$$

where:
n_i= Sample size for the i^{th} community
n = Total sample size
N_i= Population for the i^{th} community,
N=Total population.

2.3 Data Collection and

Primary data were collected through structured questionnaires administered to wheat farmers. The data collected covered socioeconomic characteristics, production inputs, output levels, costs, returns, and production constraints.

2.4 Analytical Tools

Both inferential and descriptive statistics were employed to achieve the stated research objectives. Descriptive statistics such as means, percentages, and frequencies were employed. Farm budgeting techniques, net farm income analysis, and the mean weighted score ranking technique were also employed.

$$\text{Mean Weighted Score (MWS)} = \frac{WS}{n} \quad (2)$$

where,
WS = Weighted Score
n = Sample Size
WS = (e.g., 4 x frequency)

3 Results and Discussion

3.1 Socio-Economic Characteristics of Wheat Farmers (Quantitative)

The mean age of wheat farmers was 39 years, with the largest proportion (36%) falling within the 29–39-year age bracket. This suggests that wheat production is dominated by economically active individuals capable of withstanding the physical and managerial demands of irrigated agriculture. This finding aligns with reports by the Food and Agriculture Organization (2023), which indicate that agricultural productivity in developing countries is largely driven by farmers within the active age

group. Younger farmers are typically more innovative, risk-tolerant, and receptive to improved production technologies such as high-yielding varieties and modern irrigation practices (Adamu & Mohammed, 2022; International Food Policy Research Institute, 2022).

Table 1: Socio-Economic Characteristics of Wheat Farmers (Quantitative)

Variable	Frequency	Percentage	Mean	Min.	Max.
Age					
18 – 28	33	20			
29 – 39	59	36	39	18	68
40 – 50	49	30			
51 – 61	18	11			
62 – 72	5	3			
Years of Experience					
2 – 7	53	32.3			
8 – 13	42	25.6			
14 – 19	20	12.2	14	2	30
20 – 25	35	21.3			
26 – 31	14	8.6			
Household Size					
1 – 7	73	44.5			
8 – 14	61	37.2	10	1	33
15 – 21	22	13.4			
22 – 28	7	4.3			
29 – 35	1	0.6			
Farm Size (Ha)					
0.1 – 0.4	13	8			
0.5 – 0.8	42	25.6			
0.9 – 1.2	73	44.5	0.97	0.1	2
1.3 – 1.6	26	15.8			
1.7 – 2.0	15	9.1			

Farmers had a mean farming experience of 14 years, indicating long-term engagement in wheat production. This level of experience enhances managerial efficiency, decision-making ability, and resilience to production risks. According to Issa et al. (2021), experienced farmers are better positioned to optimize input use and respond effectively to climatic and market uncertainties. Supporting this, World Bank (2023) noted that farming experience is positively correlated with productivity and profitability in irrigated agriculture across sub-Saharan Africa.

The average household size was 10 persons, implying substantial availability of family labour. This reduces dependence on hired labour, thereby lowering production costs and improving farm profitability. Large household size has been widely associated with labour supply advantages in smallholder agriculture (Ogunniyi et al., 2020). In addition, National Bureau of Statistics (2023) reports that rural households in northern Nigeria often rely heavily on family labour for farming operations, particularly in labour-intensive crops like wheat. However, large household sizes may also increase consumption pressure, potentially offsetting income gains if productivity is low.

The average farm size of 0.97 ha indicates the dominance of smallholder farmers in the study area. This is consistent with the structure of irrigated wheat production systems in northern Nigeria, where land fragmentation and limited access to large-scale irrigation infrastructure constrain farm expansion (Federal Ministry of Agriculture and Food Security, 2022). While small farm sizes can facilitate close supervision and efficient resource use, they often limit economies of scale and hinder the adoption of mechanized technologies. International Maize and Wheat Improvement Center (2022) further emphasized that small landholdings remain a major constraint to wheat productivity in sub-Saharan Africa due to restricted access to mechanization and modern inputs.

Overall, these findings suggest that wheat production in the study area is characterized by relatively young and experienced farmers operating on small-scale farms with strong reliance on household labour. While these characteristics provide certain efficiency advantages, structural constraints such as small farm size and limited

access to modern inputs may continue to restrict productivity and profitability.

3.2 Socio-Economic Characteristics of Wheat Farmers (Qualitative)

Wheat production was overwhelmingly male-dominated (96.3%), reflecting prevailing cultural norms, land tenure systems, and the labor-intensive nature of irrigated farming in northern Nigeria. In many parts of the region, access to land is largely controlled by men, limiting women's participation in cereal production systems. This finding is consistent with that of FAO (2023), which reports significant gender disparities in access to productive resources across sub-Saharan Africa. Similarly, the IFPRI (2022) noted that female farmers often face constraints in land ownership, credit access, and input utilization, thereby reducing their participation in commercial crop production such as wheat.

The high proportion of married respondents (84.8%) suggests the availability of family labour and shared household production responsibilities, which are critical in labor-intensive farming systems. Marriage in rural settings often enhances labour pooling and supports farm decision-making processes. According to the NBS (2023), married households in northern Nigeria tend to have better labour organization and higher agricultural output compared to single-headed households. This supports the assertion that household structure plays a significant role in agricultural productivity.

Educational attainment revealed that 34.2% of respondents had secondary education, 26.2% Qur'anic education, and 24.4% primary education. Education is widely recognized as a key driver of agricultural productivity, as it enhances farmers' ability to adopt improved technologies, understand extension recommendations, and efficiently manage farm resources. This finding aligns with the World Bank (2022), which emphasized that education significantly improves farmers' technical efficiency and decision-making capacity. Furthermore, studies have shown that even informal education, such as Qur'anic education, can positively influence farmers' organizational skills and social capital, thereby indirectly supporting agricultural innovation (Abdullahi et al., 2021; Food and Agriculture Organization, 2023).

Association membership was notably high (92.7%), indicating strong participation in farmer-based organizations. Cooperative membership plays a crucial role in enhancing farmers' access to credit, subsidized inputs, extension services, and market information. This is consistent with Abdullahi et al. (2021), who found that farmer organizations significantly improve input access and bargaining power among smallholders. In addition, the World Bank (2023) highlighted that collective action through cooperatives enhances economies of scale, reduces transaction costs, and facilitates technology dissemination in smallholder agriculture. Similarly, the International Maize and Wheat Improvement Center (2022) emphasized that farmer groups are critical in scaling improved wheat varieties and best agronomic practices across sub-Saharan Africa.

Table 2: Socio-Economic Characteristics of the Respondents (Qualitative)

Variable	Frequency	Percentage
Sex		
Male	158	96.3
Female	6	3.7
Marital Status		
Single	21	12.8
Married	139	84.8
Widow	4	2.4
Level of Education		
Primary	40	24.4
Secondary	56	34.2
Tertiary	25	15.2
Qur'an	43	26.2
Association Membership		
Member	152	92.7
Non-Member	12	7.3

Overall, these findings suggest that wheat production in the study area is shaped by gender dynamics, household structure, education level, and institutional participation. While male dominance and high cooperative membership provide certain structural advantages, addressing gender inequality and strengthening inclusive access to resources remain essential for improving productivity and sustainability.

Wheat production was male-dominated (96.3%), reflecting cultural norms, land ownership structures, and labour requirements. Similar gender imbalances have been reported in cereal production systems across Northern Nigeria (FAO, 2023). Most respondents (84.8%) were married, suggesting access to family labour and shared household production responsibilities. Educational attainment showed that 34.2% had secondary education, 26.2% Qur'anic education, and 24.4% primary education. Education enhances farmers' ability to adopt improved technologies, interpret extension messages, and manage farm finances (World Bank, 2022). Association membership was high (92.7%), indicating strong participation in farmer groups. Cooperative membership improves access to credit, subsidized inputs, training, and market information (Abdullahi et al., 2021).

3.3 Profitability Analysis

Table 3 presents the results of the analysis of cost components and returns for the wheat production enterprise in Jigawa State. The variable cost components considered in this study include seeds, fertilizers, agrochemicals, land rental, and petroleum products. Labour cost components such as land preparation, watering, ploughing, planting, fertilizer application, weeding, spraying, and harvesting were also incorporated into the variable costs. In addition, the analysis accounted for the depreciated cost of fixed inputs used in wheat production.

Table 3: Profitability Analysis of Wheat Production

Cost Components	Average Cost (₦)	Percentage Contribution to Average Total Cost
Variable Inputs		
Seed (Kg)	70,865.46	9
Petrol (L)	109,314.29	14
Fertilizer (Kg)	196,704.10	25
Labor (Manday)	271,132.70	34.5
Agrochemicals (L)	43,188.98	5.5
Land rental cost (Ha)	31,897.96	4
Total Variable Cost	723,103.49	92
Fixed Inputs (depreciated)		
Water Pump (₦)	45,803.60	6
Hose/Siphon	8,897.89	1.1
Hoe (₦)	978.20	0.12
Axe (₦)	899.60	0.11
Sickle (₦)	558.80	0.07
Sprayer (₦)	4,447.10	0.56
Total Fixed Cost	61,585.20	8
Average Total Cost	784,688.69	100
3. Returns		
Average Yield (Kg/ ha)	3,934.10	
Average Price (₦/Kg)	466.13	
Gross Revenue (₦/ha)	1,831,364.00	
Gross Margin	1,108,260.51	
Net Income (₦/ha)	1,046,675.31	
Return to ₦ Invested	1.53	

The results revealed an average total production cost of ₦784,688.69 per hectare, with variable costs accounting for 92% of the total cost. This indicates that wheat production in the study area is highly input-intensive. Labour constituted the largest cost component (34.5%), followed by fertilizer (25%), fuel (14%), and seed (9%). The dominance of labour costs reflects the labour-intensive nature of irrigated wheat farming in northern Nigeria, where mechanization remains limited. Rising fertilizer and energy costs have been widely identified as major drivers of production expenses in cereal systems across sub-Saharan Africa (FAO, 2023; International Food

Policy Research Institute, 2023). Similarly, the World Bank (2023) reports that increasing input prices, particularly fertilizers and fuel, continue to exert significant pressure on farm profitability in Nigeria.

The findings further showed an average yield of 3,934.1 kg/ha, which generated a gross revenue of ₦1,831,364 per hectare. The gross margin was estimated at ₦1,108,260.51, while the net farm income stood at ₦1,046,675.31 per hectare. The return on investment (ROI) of 1.53 implies that every ₦1 invested yields ₦1.53, indicating the strong profitability of wheat production in the study area. This level of profitability suggests that wheat farming remains an economically viable enterprise despite rising input costs. The result is consistent with earlier findings by Sani et al. (2020) and Mohammed et al. (2021), who reported positive gross margins and favorable returns among wheat farmers in northern Nigeria. More recent evidence from the International Maize and Wheat Improvement Center (2023) further confirms that improved wheat varieties and better agronomic practices have enhanced productivity and profitability in irrigated systems across the region. In general, the results highlight that while wheat production in the study area is profitable, its sustainability is highly dependent on efficient input use and cost management, particularly in the face of rising fertilizer and energy prices.

3.4 Constraints to Wheat Production

Agricultural production activities are largely constrained by several factors across their entire operations. Wheat production enterprise is not exempt from this scenario. Therefore, the results of the analysis of constraints to the wheat production enterprise are given in Table 4. The identified constraints were ranked by severity using the Mean Weighted Score (MWS). The result revealed that high fuel prices ranked first (MWS = 3.8), followed by high fertilizer costs (MWS = 3.6), high irrigation facility costs (MWS = 3.1), and untimely subsidized input supply (MWS = 2.8).

Table 4: Constraints Faced by Wheat Farmers

S/N	Constraints	WS	MWS	Rank
i.	High fuel price	368	3.8	1st
ii.	High cost of fertilizer	353	3.6	2nd
iii.	High cost of irrigation facilities	301	3.1	3rd
iv.	An untimely supply of subsidized inputs from the government	279	2.8	4th
v.	Inadequate transportation facilities	239	2.4	5st
vi.	Pest and diseases	214	2.2	6th
vii.	High cost of seed	210	2.1	7rd

High fuel costs directly affect irrigation pumping expenses, thereby increasing production costs. Fertilizer price increases also reduce optimal application rates, thereby negatively affecting yield (IFDC, 2022). Irrigation infrastructure costs limit the expansion of wheat cultivation, while delays in the delivery of subsidized inputs disrupt planting schedules. Transportation challenges and pest infestations further reduce net farm returns.

4 Conclusion

The study concludes that wheat production in Jigawa State is predominantly undertaken by economically active, relatively young, and experienced smallholder farmers operating on less than one hectare per household. These farmers rely heavily on family labour and exhibit high levels of cooperative membership, which enhances access to credit, inputs, and market information. Profitability analysis indicated that wheat farming is financially viable, with a return on investment of 1.53, despite high input intensity and rising costs of labour, fertilizer, and fuel. However, the enterprise faces significant constraints, including high fuel and fertilizer prices, expensive irrigation infrastructure, untimely supply of subsidized inputs, transportation challenges, and pest infestations, which limit optimal productivity. Small farm sizes further restrict the adoption of mechanized practices, potentially constraining economies of scale.

From the findings of this research, the following recommendations were designed:

i. Investment in solar and gravity-powered irrigation systems should be promoted to reduce fuel dependency.
ii. Affordable agricultural credit should be provided to wheat farmers through formal lending institutions.
iii. Extension services should intensify farmer training on improved wheat production technologies.

iv. Rural road infrastructure should be improved to reduce transportation costs.
v. Farmer cooperatives should be strengthened to enhance input access and collective marketing.
vi. Research institutes should develop and disseminate high-yield, drought-tolerant wheat varieties.
vii. Government should strengthen fertilizer and seed subsidy programs to reduce production costs.

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