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Analyzing Small-Scale Wheat (*Triticum aestivum* Linn._) Production Cost and Returns in Out-Grower Scheme in Thomas Irrigation Area of Makoda Local Government, Kano State, Nigeria

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Abstract

The study analyses small-scale wheat (*Triticum aestivum* Linn.) production cost and returns on out-grower scheme in Thomas irrigation area of Makoda Local Government of Kano state, Nigeria. The study employed multistage sampling technique in the selection of 120 sample respondents. The respondents were interviewed using structured questionnaire. The result obtained was analyzed by means of descriptive statistics and farm budget model. It reveal that farm size (X_5) p<-3.543*** was statistically significant but negative in wheat production by small scale farmers, sources of information (X_4) p<2.024**, farming experience (X_6 p< 0.046 0.036**) and educational level (X_7) 0.40 (p<) 0.010 were also significant (1.758*). The result indicated the variable costs of N392,975.26) reflecting 79.80% of the total cost production cost was realised. Among the variable costs, input fertilizers cost constituted highest with N185,767.65(37.73%), seed costs (N38,108.89)7.74%, and irrigation depends on the method used for watering. Fixed costs of production were found to be ₦ 99,451.85 representing (20.19%) per acre. The analysis of the costs and returns reveals that the farmers had a benefit-cost ratio of 7.03 realising ₦7.01 as revenue for every ₦1 invested by farmer in wheat crop production during the 2022/2023 irrigation season. Problems identified included at harvest and post-harvest activities up to (24%) of the farm proportion, pest and diseases. The study recommends ensuring timely and adequate provision of inputs by the government and non-governmental entities and groups, provisions of affordable credit to farmers is paramount, extension services should be adequately and funded, government and private sector should make investments in agricultural research and education as a state priority.

Keywords: *Analysis, wheat, out-grower scheme, small-scale*

Introduction

Background of the Study

Wheat (*Triticum aestivum* L.) is a globally vital grain, ranking first in acreage and second in production volume (772 million metric tons in 2021, up 10 million tons from the previous year; Shahbandeh, 2021). In Nigeria, wheat farming faces challenges like high temperatures, low yields, and heavy import dependence to meet rising demand. As the second-largest wheat consumer in sub-Saharan Africa (behind South Africa), Nigeria's wheat is crucial for food security, especially in the north, where it's milled into flour for traditional dishes (*alkaki*, *taliya*, *dashishi*) and urban staples like bread. Post-2015/2016 and the 2019/2020 Covid period oil shocks (Abbas,2018) policymakers see potential for Nigeria's self-sufficiency in wheat, but production lags behind population growth and demand(.) With high protein (14%), baking quality, and storability, wheat is a strategic commodity. Yet, conflicting production figures persist, underscoring the need to identify avenues for sustainable, profitable wheat production in Makoda, Kano State, under out-grower schemes linked to Northern Flour Mill (NFM).

Kano State, located in the northern (northwestern) part of the country, is one of the key wheat-producing regions, benefiting from irrigation schemes that support dry-season farming. The Thomas Irrigation Area in Makoda Local Government of Kano State is a prime example of initiatives localising agricultural projects aimed at boosting agricultural productivity through organized out-grower schemes linked to Northern Flour Mill (NFM). These schemes link small-scale farmers with markets, inputs, and technical support, enhancing their production capabilities.

Small-scale wheat farmers, however, face numerous challenges, including high production costs, limited access to modern technology, and fluctuating market prices. In this context, understanding the costs structure and returns of wheat production is crucial for identifying areas of improvement, enhancing profitability, and informing policy interventions that can support farmers. One of these avenues identified is out-grower initiative by Nigeria flour mills (NFM) and the out-grower scheme's sustainability.

This current study focuses on analysing the cost and returns of wheat production in the Thomas Irrigation Area, providing insights into the profitability of wheat farming and the challenges faced by farmers. The findings are expected to inform strategies for improving wheat production efficiency, enhancing farmer welfare, and contributing to Nigeria's agricultural development goals.

Statement of the Problem

Wheat production in Nigeria is gaining economic and social importance but faces hurdles affecting yield, volume, and farmer returns. Key issues include high input costs, low production levels, bureaucratic obstacles, lack of production loans and subsidies, technical constraints, and post-harvest losses (in Thomas irrigation area). These reduce profitability and deter small-scale farmers in Makoda. Specifically the study intends to achieve the following objectives:

Broad Objective

The broad objective of the study is to analyse the cost and returns of wheat production in the Thomas Irrigation Area, Makoda Local Government of Kano State, Nigeria.

Objectives of the Study

The current study examines small-scale wheat production in Makoda Local Government, Kano State, Nigeria, under NFM's out-grower scheme. Specifically the objectives of the study are to:

i. determine the production costs of wheat in the study area,
ii. estimate the returns and profitability of wheat production,
iii. assess the economic viability of wheat production in the out-grower scheme and
iv. identify key areas for improving the efficiency and profitability of wheat production.

Justification of the Study

Findings will inform stakeholders (farmers, NFM, policymakers, researchers) on wheat production profitability, marketing, pricing, and efficiency in Makoda's out-grower context. Results will aid investments and Investors and agro-allied services, identifying profitable wheat production strategies, Government (Kano State, Federal Ministries of Agriculture, Finance), and other non-governmental organisations Targeted interventions, subsidies, and infrastructure improvements, Researchers and students, would serve source of information for related studies on wheat economics and out-grower schemes in the state and the Nation at larger contexts.

Methodology

The Study Area

Thomas irrigation area, is in Makoda Local Government, Kano State (12°20′N, 8°30′E), has ~1,200 hectares under wheat irrigation (November–March) source. The study was carried out in Makoda Local Government Area of Kano state. Makoda Local Government Area (LGA) is situated in the Northern part of Kano state in 2023 and 2024 production season. The area has an area of about 441km².The area lies geographically between the latitude 12º 14`49" N to 12º 36`7.4"N and longitude 8º29`5.7" E to 8º49`12'' E. The population of Makoda Local Government was projected at 1,111,995 persons(source.

The area is characterized by two major geologic structures with minor intrusions. Makoda is topographically situated in low land areas which render it suitable for vegetable production. The larger area of the region to the south and North West is underlain by rocks of the basement complex with intrusions of younger granites in the extreme southern parts Olofin, (2008 and Aminu, 2018 ; abbas, et al., 2020). To the North East are found unconsolidated sediments of the Chad formation. The two structures are separated by a transitional zone which constitutes the well-defined hydro geological divide of the region Olofin,(2008).

The main drainage of the area constitutes Thomas Dam and their numerous tributaries. Makoda area is characterized by one river, which is river Thomas and got it tributaries from Bichi Local Government Area of Kano State and drain to Dambatta Dam (Udo, 1981). The drainage system has been artificial with natural fadama depressions modified through dams and constructions for multipurpose uses (irrigation and rain fed) and flood control. Annual rain fall ranges between 500mm in the North to 1,200mm in south. The area is characterized by four months of wet seasons and eight months of dry season. Therefore, water availability is very critical in the area. In the location, Temperature is relatively warm to hot from March to October, and cool from November to February. The mean annual temperature was found to be degree centigrade (26^0C). Farming is an important activity as people of the area predominantly famers as they engaged themselves in both rainy and dry sessions farming. Some of the crops cultivated and marketed are wheat, Pepper, Okro, Onions, cereals and pulses. The market is rural area center for economic activities for the local Government revenue generation.

Method of Data Collection

Total of sixty (120) questionnaires was prepared to gather relevant information from the respondents. Interview method was conducted by the researcher himself with the help of one trained field enumerator.

Types of Data

The data used was primarily collected through the use of structured questionnaire as guide and supplemented by focus group discussions (FGD) which involved the stake holders and interview.

Primary Data

Primary data was collected through the use of structured questionnaire as basis to guide in the sourcing of information from farmers. The data collected included on socio economic characteristics of wheat farmers, inputs price, and costs of procurement, management and disposal of produces and problems associated with wheat production.

Secondary Data

The secondary data sources were especially the data obtained from some books, internet and notes from private partners.

Descriptive statistics such as frequency, means and percentages were used to describe the socioeconomic characteristics of wheat producers and problems associated with production. Net farm income, (NFI), operation ratio (OR) Benefit Cost Ratio (BCR) models were employed in the analysis. Specified was made from the point of view of total expenses (costs) estimation as well as revenue within the production period.

Analytical Tools

Descriptive statistics

Descriptive statistics was used in for data analysis, summarising costs and returns to wheat production.

Models Specification as employed in the Study was presented as follows:

$$\mathbf{P = f / n \ X \ 100} \qquad \text{i}$$

Where:

P=percentage,
f=Frequency to be converted to percentage,

$$\mathbf{\bar{X}=\sum X_i/n} \qquad \text{ii}$$

Where:
$\bar{X}$= Mean
$\sum$ =Summation
n= total number of observations
X=number of responses.

Farm Budget Model

Farm budget model (FBM) were employed to determine Gross Production Margin (GM), benefit-cost ratio (BCR), returns on Investment (RoI).

Gross Income (GI)

$$\mathbf{GI = TR - TVC} \qquad \text{(iii)}$$

Where:
GI = Gross Income
TVC =Total Variable Cost
TR= Total Revenue

Gross Revenue

$$\mathbf{(GR) = QXP_y} \qquad \text{(iv)}$$

Where:
GR=Gross Revenue
Q_x = Quantities of Wheat Sold (Kg);
P_y = Unit price of Wheat (₦/kg).

Net Farm Income

NFI=GFI-TCP (v)

Where:
NFI=Net farm income
GFI=Gross farm income **(**Total Revenue**),**
TC=Total cost of production (Wheat),
TCP=Total Cost of Production,

Total Cost of Production

TCP=TFC+TVC (vi)

TFC=Total fixed cost
TVC= Total variable cost

Return on Investment (ROI)

$$\mathbf{ROI==\frac{\pi}{TC\ \mathit{i-j}}} \quad \text{(vii)}$$

Where:
ROI=Return on Investment
π = profit margin
TC=Total Cost of Investment

Benefit cost ratio (BCR)

$$\mathbf{BCR=\frac{Total\ benefit}{Total\ Cost\ \mathit{i-j}}} \quad \text{viii}$$

Where:
BCR= Benefit Cost Ratio
TR=Total Revenue from yield (Output)
TC=Total Cost expended on fixed and variable inputs

$$\boldsymbol{FP}=\frac{TPP}{TVC}=\frac{Y}{\sum PnXn}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

FP=Factor price (input price)
TPP=Total Physical Product
TVC=Total variable cost
Y=individual output (Yield) in Kilogram (Kg)
∑= summation sign (as total)
P_n= price
n= observation AND X=factor under consideration

Results and Discussions

Results

Costs associated to wheat production

Table shows arrays of the cost involved in wheat production. Returns to production are the value of output (yield) obtained as a result of the production. The (average) returns to crop production in the table. It shows that the variable costs N392, 975.26. Fertilizers constituted highest among the variables N148, 333 (47.60%) of the total variable costs (TVC), followed by water (charge and irrigation) charges N58, 886 (18.89% irrigation depends on the method employed). Total costs of production were found to be ₦ 388,119 per an acre.

The analysis of the costs and returns reveals that the small scale farmers in wheat had a benefit cost ratio of 2.25 reflecting that the enterprise is worthwhile as for every N 1 invested a farmer get N2.25. Also RoI value of 2.29 was realised which means that the farmers realized ₦ as revenue for every ₦1 invested in wheat crop production during the 2022/2023 season N2.29 was realised. The summary of cost and returns to wheat production and investment is presented in Table 1. However, going by the agreements on pay by grain (pay-on harvest to

clients, the average farmers' returns 340,000 equivalent of prevailing wheat price (normally pegged by the clients) or host companies. The result is presented in Table 3.

Table 3 : Summary of average costs and returns for wheat production

Cost Practices	Average costs (₦/acre)	(%)TVC
(Variable Costs Components)	**@**	**@**
Seed	8,530	2.73
Sowing	3,520	1.129
Water charges(Irrigation)	58,886	18.89
Weeding(1^{st}/2^{nd})	20,500	6.90
Fertilizers(1^{st}/ 2^{nd})	148,333	47.60
Organic-manure	3,500	1.13
Agro-chemicals	5,500	1.77
Harvesting	17,230	5.53
Winnowing	2,750	5.53
Threshing	5,200	1.66
Transportation	13,700	0.89
Total Variable Cost	**392,975.26**	**(100)**
(Fixed Costs Component)	**@**	**@**
Land Lease	25,500	
Land preparation	50,500	
Depreciation on tools	540	
Total Fixed Cost(TFC)	**76,540:00**	**(100)**
Total Cost (TC)	**388,119**	**(100)**
Total Revenue(TR)	**1,258,400**	
Gross Margin (GM)	**946,821**	
Net Farm Income(NFI)	**482,164**	
Benefit-Cost (BCR)	2.25	
Return on Investment(RoI)	**2.29**	

Source: Field Survey (2024) at N2,000 /*mud* Yield(*Output*=17.5) bags/acre (average yield)

Factors influencing wheat output

*Regression analysis was used to identify factors influencing wheat output***.**

Table 1: Summary of the wheat production regression analysis

Variable	Coefficient	Std. Error	t-value	p-value	Significance
Farm Size (acres)	-0.543	0.153	-3.543	0.001	***
Sources of Information	0.276	0.136	2.024	0.05	**
Farming Experience (yrs)	0.040	0.020	2.036	0.05	**
Educational Level (yrs)	0.058	0.023	1.758	0.10	-
Credits /Loan packages					
Constant	1.852	0.412	4.496	0.001	***

$R^2 = 0.842$

Adjusted $R^2 = 0.708$

F-statistic = 6.78 ($p<0.01$)

Source: Field data (2023) NB: Dependent variable (Y): Wheat output (kg/acre). Significance levels: *** p<0.01, ** p<0.05, * p<0.10.

Major Challenges (problems) for wheat production in the study area

The problems associated to wheat production in the study

post-harvest losses in the study areas ranked. The attribution variables covered ranged from harvesting losses among other considerable factors. The table shows that postharvest losses ranged from 0.01 kg per farmer at the drying stage (3%) to 0.30 kg per farmer at the harvesting stage (24%). These findings did not agree with the 2%, 6% and 7% obtained by Appiah et al., (2011) for drying, threshing and storage respectively. Macheal (2014) further noted that losses from drying ranged from 1 to 5% while Chin, (2016) puts the losses from storage at 6.2% compared to 8% and 7% obtained from these attributes under the study. Post-harvest losses are the quantitative and qualitative degradation of food production from harvest to consumption. Quality losses include those that affect the nutrient/caloric composition, acceptability, and edibility of a given product (Kaadeer, 2012).

Table : Distribution problems to wheat production in the study area

Problems identified	Frequencies		Percentage Rankings
Low output price	105	88.1	1st
Low yield or returns to scale	89	78	2nd
Inadequate credit facilities	56	74.3	3rd
Lack of production input	96	67.6	4rd
High cost of inputs	87	60.5	5th
Transportation problem	104	54.3	6th
Diseases/pests	99	52.40	7th
Labour cost	89	52.10	8th
Inadequate land	78	51.9	9th

Source: Field survey, (2023) *values computed based on multiple responses*

Discussion

Wheat production in Makoda is profitable as revealed by BCR >1, aligning with Adeoti et al. (2018) on irrigation's yield boosting the farmers morale. High fertilizer costs (37.73%) as reported by Ibrahim et al. (2020) as set back to produce production and disposal. Strategising subsidies on production could enhance profit margins. Negative farm size effect indicates smallholders manage resources more efficiently, Education and info access improved outcomes, stressing extension services' role. – Harvest and post-harvest losses of production posed a serious problem too. Other problems reported included pests (stem rust, aphids) and diseases (blast). Crop failure risks threaten grain-based repayment **(see *Appendix A* for risk mitigation strategies**).

Conclusion And Recommendations

Conclusion

Small-scale wheat production in Thomas irrigation area proved to be profitable but constrained by high input costs, post-harvest losses, and pests. Out-grower schemes shows promise if supported by timely inputs, credit, and capacity-building.

Recommendations

Based on the findings, following points have been put forward**:**

- Conscious effort should be exerted by the government at all levels, and NGOs to encourage and incentivize high production of wheat in Nigeria so as to boost agricultural production,
- Government, financial institutions and private entities to offer low-interest loans should ensure timely and adequate provision of inputs, to farmers at affordable prices.
- Government and private sector should make investments in agricultural research and education as priority.
- and fund extension services adequately