



ANALYSIS OF WHEAT PRODUCTION EFFICIENCIES IN HADEJIA AND RINGIM LOCAL GOVERNMENT AREAS OF JIGAWA STATE, NIGERIA

***Samson, G. L., Haruna, U. and Idi, S.**

Department of Agricultural Economics, Faculty of Agriculture and Agricultural Technology,
Abubakar Tafawa Balewa University, Bauchi, Nigeria.

***Corresponding Author's E-mail:** glolima14@yahoo.com, **GSM:** +2348023586813

ABSTRACT

The study analyzed wheat production efficiencies in Hadejia and Ringim Local Government Areas of Jigawa State, Nigeria. A multi-stage sampling technique was used to select 154 wheat farmers. Data was collected using structured questionnaire and analyzed using both descriptive and inferential statistics. The results showed that most (92.2%) of the respondents were male while almost half (43.5%) of the respondents fell within the age bracket of 29 – 40 years with mean age 42 years and majority (80.5%) of the respondents were married with household size of 5 – 8 persons, accounting for 29.2% of the respondents with mean household of 8 persons. Also, ₦85,750.00 was realized as a revenue from the sales of 1.15 hectares of wheat with gross margin ₦50,713.00 and the return per naira invested was ₦1.53 respectively. Majority (76.0%) of the respondents agreed that use of improve seed leads technical efficiency which provides high and quality output. Stochastic production frontier revealed that application of quality fertilizer ($p < 0.01$), access to human labour ($p < 0.01$), and adequate herbicides ($p < 0.05$) significantly influenced wheat production while farming experience ($p < 0.1$) significantly influenced production efficiency of the wheat farmers while coefficient of fertilizer application (kg/ha) revealed that increase by 1%, will increase production by 0.126 %. Also, farmers' age revealed that the technical inefficiency of wheat farmers increased with age. The negative coefficient of farming experience revealed that the technical inefficiency of wheat farmers decreased with more experience. The results further revealed that poor quality of seedlings (70.2%), poor road network (59.6%), and inadequate labour source (49.0%), limited access to financial services (48.3%) and limited access to inputs (47.0%) were the major constraints faced by the respondents in the study area. The study concluded that adoption of improve seed, use of modern practice and use of quality fertilizer will ensure technical efficiency among the wheat farmers and also wheat production can be increased significantly by adopting a number of measures. The study recommends that agricultural finance institutions should focus on provision of credit for purchase of equipment and farm inputs. This can be done through farmers' cooperatives and other organizations at the local level. The Ministry of Agriculture, through the National Cereals and Produce Board, should import and distribute fertilizers to depots within the vicinity of farmers and introduce a price cap on the costs.

Keywords: Coefficient, Extension, Wheat, Stochastic, Efficiency, Reconnaissance

INTRODUCTION

Jigawa State is blessed with large expanse of agricultural land, rivers and flood plains, suitable for crops, livestock and fish production. Based on this, over 80% of the State total land mass is considered arable, which makes it one of the most agriculturally endowed States in Nigeria. According to FAO (2016), the major cultivations in Jigawa State are the rainy and dry season crops. Rain fed crops include millet, sorghum, cowpea, groundnuts, sesame, rice,



maize, sweet potatoes, Bambara nuts, water melon, cassava, cotton, okra, Roselle and water melon. The dry season farming production include tomatoes, pepper, onions, wheat, sugarcane, carrots, cabbage, lettuce, maize and a host of other leafy vegetables. Ministry of agriculture Jigawa state Medium Term Sector Strategy (MTSS). About 90% of the 4.3 million people of Jigawa State are predominantly engaged in Agriculture, making the sector the major source of livelihoods, food security and poverty reduction. , The State Economic Empowerment Development Strategy (SEEDS1) and the Comprehensive Development Framework (CDF) have been the leading policies of Governments since 2006. These policy strategies consist in the provision of pre-harvest and post-harvest support with respect to storage; processing and marketing of Agricultural produce covering both food crops and industrial crops. Also the strategies include rural development components that target the provision of rural infrastructure for sustainable rural livelihood (World Bank, 2016).

Wheat has been cultivated in Nigeria for several centuries especially, in the northern states in the hydromorphic lowlands or valleys and watercourse in the relatively cooler area. However, large scale production to meet local demands for bread, cakes and other confectionaries commenced after the development of irrigation schemes in 1959 at Wurno, Hadejia, Yau and Gamboru Ngala (Elijah, 2016). Wheat demand is very high in Nigeria as a result of increasing population and urbanization, and large proportion of the demand is met through importation and efforts to satisfy local consumption through domestic production have failed because of many technical and political problems (Elijah, 2016).

Wheat is a key food staple that provides around 20% of protein and calories consumed worldwide. Demand for wheat is projected to continue to grow over the coming decades, particularly in the developing world to feed an increasing population, and with wheat being a preferred food, continuing to account for a substantial share of human energy needs in 2050 (Wageningen *et al.*, 2016). Based on recent trends, an increasing number of poor consumers in low- and middle-income countries will want to eat wheat-based food at an affordable price as populations and economies grow, women and men seek employment in cities, and dietary habits change. The superior low performance of CNDO and Ster/TR in terms of grain yield appears to have been supported by the high values of yield attributes recorded. Miko *et al.* (2016), in a similar study had reported that varieties with high yield potentials were supported by superior values of yield attributes. According to Iken and Amusa (2014), research on methods of cultivating wheat to a large extent is secondary since designing of efficient farming system was given a priority. Umoh (2016), also concluded that efficiency has remained an important subject of empirical investigation particularly in developing economies where majority of farmers are resource – poor. It has been observed that maize has not been produced to meet the demand of the people within and around Yola metropolis in Adamawa State, Nigeria. For this reason, the study was conducted to analyze cost efficiency of rain fed wheat farming in Hadejia Local Government Area of Jigawa State. As reported by Abu (2018), Ethiopia remains one of the largest recipients of food aid in Africa, receiving around 27% of the global food aid given to sub-Saharan Africa. Due to low productivity of wheat and supplies of wheat for consumer from May through October before the harvest start and sold to flour mills, consumer associations, organized governments, and private sector employees. The broad objective of this study was to analyze the wheat production efficiencies in Hadejia and Ringim Local Government Areas of Jigawa State, Nigeria, while specific objectives were to; describe the socio-economic characteristics of the wheat farmers; estimate the costs and returns components of the wheat farmers; determine

the production efficiency of wheat and describe the major constraints faced by the wheat farmers.

MATERIALS AND METHODS

The Study Area

Hadejia LGA, lies between latitude $12.45^{\circ}6'N$ and longitude $10^{\circ}40'E$ with an area of $3,871\text{km}^2$. Hadejia has a projected population of approximately 110,753 (NBS, 2021), it has an average daily high $35^{\circ}C$ and lowest $21^{\circ}C$ temperature and rainfall range of 200 – 600mm. Hadejia LGA engage in many economic activities are Crop production, Rearing of small and large ruminants as well as marketing of agricultural products.

Ringim LGA's. Its headquarter is in Ringim Town with an area of $1,057\text{km}^2$ with an annual projection population approximately of 14,477 (NBS, 2021) it has an average daily high $36^{\circ}C$ and lowest $19^{\circ}C$ temperature respectively it also has a rainfall range 500 – 600mm, Ringim lies between the coordinate $12^{\circ}17'N$ and $9^{\circ}28'E$. Ringim LGA engages in economic activities such Crop production, rearing of small and large ruminants as well as marketing of agricultural products.

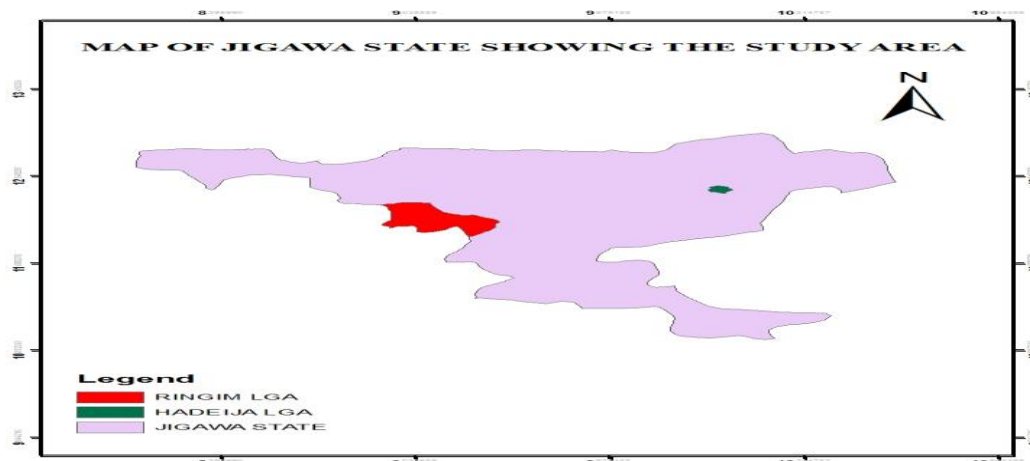


Fig. 1: Map of Jigawa State showing the Study Areas Hadejia and Ringim LGA's

Source: Reconnaissance survey (2021)

Sampling Techniques and Sample Size

A multi-stage sampling technique was employed. In the first stage, two districts were selected using purposive sampling techniques. In the second stage, two Local Government Areas (LGAs) Hadejia and Ringim were randomly selected from each district making a total of two LGA's. In the third stage, three villages were randomly selected from each of the LGAs making a total of six (6) villages. In the final stage, proportionately 30% of the sampling frame were randomly selected as a sample size.

Table 1: Sample Frame and Sample size Plan of the Study

LGA's	Villages	Sample frame	Sample size @ 30%
Ringim	Zangon – Kanya	65	20
	Daurawa	70	21
	Ringim	120	36
Sub – total		255	77
Hadejia	Chadi	80	24
	Matsaro	85	26
	Garko	90	27
Sub – total		255	77
Total		510	154

Source: Field survey, 2021

Methods of Data Collection

The research utilized primary data. The study used structured questionnaire to collect data from the selected cowpea farmers in the study area. The questionnaire were administered to the respondents who were engaged in the production of wheat in the study area.

Methods of Data Analysis

The research utilized the use of both descriptive and inferential statistics to achieve the research objectives.

Descriptive statistics

Descriptive statistic such as; mean, frequency distribution, bar chart, pie chart and percentages was used to achieve objectives i and iv.

Gross Margin

This was used to achieve objective ii in order to estimate the cost and returns of the wheat farmers in the study area. This is given by the following formula.

$$GM = TR - TVC \quad \text{..... (1)}$$

Where;

TR = is the total amount obtained from the sales of the produce (output).

TVC + TFC

The total variable cost (TVC) includes cost of labour, amount of produce incurred, transportation, while total fixed cost (TFC) includes depreciation of farm implements and tools. Using a straight line method, would be used to determine the depreciation expenses. The total revenue would be total output multiplied by the price per unit of produce from the market.

Inferential Statistics

Inferential statistic such as; Stochastic frontier production was used to achieve the objectives iii.

Stochastic Frontier Production

Stochastic frontier production was used to achieve objective 3 in order to determine the production efficiency of wheat farmers in the study area.

$$\ln Y_j = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + (V_j - U_j) \quad \text{.....(2)}$$

Where, Y= Production of wheat (q/ha)

X₁ = Seed (kg/ha)

X₂ = Fertilizer (kg/ha)

X₃ = Human labour (hrs/ha)

X_4 = Herbicide (ltr)

V_j = Stochastic error term

U_j = Technical inefficiency effect predicted by the model

The inefficiency model is as follows:

$$U_j = \delta_0 + \delta_j Z_i \dots \dots \dots (3)$$

Where: U_j = Technical inefficiency effect

Z_{ij} = Values of explanatory variables (i^{th} variable) for technical inefficiency effect for the j^{th} farmer (where $j=1, 2, \dots, n$ and $i=1, 2, \dots, 5$)

Z_1 = Age of the j^{th} farmer

Z_2 = Income generation of j^{th} farmer

Z_3 = Farming experience of j^{th} farmer

RESULTS AND DISCUSSION

Socio-economic Characteristics of Wheat farmers

Sex of the respondents

Sex refers to the biological form of human being a male or female, it's a factor of socio-economic characteristics which points out the sex group which involve in wheat farming. Table 2 shows distribution of respondents according to sex. The majority () of the respondents were male. This indicates the dominance of the male among the farmers. The result showed that most (92.2%) of the respondents were male while the females constituted 7.8%. This implies that males are more engage in farming activities whereas females headed household's activities. This is in accordance with the findings of (Falola *et al.*, 2018) on socio-economic characteristics of the farming households. Reported that majority () of the respondents were male. This indicates the dominance of the male among the farmers. Majority (70.5%) of the respondents were within the age range of 30–50 years. Also Bose (2019) opined that total sampled households, about 94% were male-headed with mean household size of 12 indicating a large household which is not unexpected in this part of the country where many polygamous homes exist.

Table 2: Distribution of the Respondents according to Sex

Variable	Frequency	Percentage
Male	142	92.2
Female	12	7.8
Total	154	100.0

Source: Field Survey, 2021

Age of the respondents

Age refers to the length of time the farmers has lived for distinct period of history. The result in Table 3 revealed that 43.5% of the respondents fell within the age bracket of 29 – 40 years. About 23.4.5% of the respondents were within the age range of 41 – 50 years. While, 5.8% of the farmers fell within the age bracket 51 – 60 years and only 0.6% fell with the age group above 61years. Further analysis revealed that the mean age of the respondents was 42 years. This suggests that the farmers were still in their active age. According to report of (Folola *et al.*, 2013) postulate further analysis revealed that the mean age of the respondents was 42 years. This suggests that the farmers were still in their active age. It is noteworthy, however, that just 10.5% of the respondents were not older than 30 years, which is the official age limit recognized by the National Youth Service Corps (NYSC) in Nigeria

for an individual to be referred to as being a youth. This might be due to the high level of apathy exhibited by the youth to agriculture (16-20). Furthermore, Jamilu (2014) stated that age of the farmers ranged from 21 to above 60 years with a mean of about 40 years. This means that the respondents are still in their active and productive age thus possess the energy needed to carry out income earning activities for improved household welfare.

Table 3: Distribution of the Respondents according to Age

Variables	Frequency	Percentage
29 – 40	67	43.5
41 – 50	36	23.4
51 – 60	9	5.8
61 and Above	1	0.6
Total	154	100.0

Source: Field Survey, 2021

Marital status

Marital status is an important socio-economic factor of wheat farmers that are engage in wheat production. The result in Table 4 indicates that overwhelming majority (80.5%) of the respondents were married and 14.9% were single and 3.9% were widows while 0.6% was divorced. According Najafi (2017) majority of the respondents as study was undertaken in northern part of Nigeria, it is not surprising that most (94%) of the respondents were married and about 64%. In addition, the finding is similar to that of other researchers (Adagba, 2019) in separate studies that the majority (ranging from 50-95%) of rural farmers were married and Jamilu (2014) that rural households in Kaduna State have an average of 11 members.

Table 4: Distribution of Respondents according to Marital Status

Variables	Frequency	Percentage
Single	23	14.9
Married	124	80.5
Divorced	6	3.9
Widowed	1	.6
Total	154	100.0

Source: Field Survey, 2021

Household Size of the Respondents

Household size means the total number of household members residing or that will be legally residing, in a dwelling unit. These include the husband, wives, children and other dependents that eat from the same pot. The result as presented in Table 5 showed that about 29.9% of the household heads were married. The household size of the respondents ranged from one to five members. Catering for the family in the study area. Modal group was 5 –8 persons, accounting for 29.2% of the respondents. Further analysis revealed that the mean household size of the respondents was eight persons. These results likely suggest that wheat farming was a means their farm inputs from own farm (previous harvest). The household size of the respondents ranged from one to seventeen members. The modal group was 6–10 persons, accounting for 56.2% of the respondents. Further analysis revealed that the mean household size of the respondents was eight persons. These results likely suggest that wheat farming was a means of catering for the family in the study area Mustapha (2016).



Table 5: Distribution of Respondents according Household Size

Variables	Frequency	Percentage
None	23	14.9
1 – 4	46	29.9
5 – 8	45	29.2
8 – 10	23	14.9
10 -12	16	10.4
13 and Above	1	.6
Total	154	100.0

Source: Field Survey, 2021

Factor Responsible for Efficiency in Wheat Farming

The results from 6 table indicates that majority (76.0%) of the wheat farmers agreed that use of improve seed leads technical efficiency which provides high and quality output during the bumper harvest of the produce. While use of modern practice depict (64.3%) which leads to high rate of production among the wheat farmers also use of quality fertilizer (64.6%) of the respondents admit that farmer's using a high quality fertilizer indicate high significant increase in the wheat growth, this was as a results of use of quality fertilizer by the wheat farmers in the study area in the study area. The result also shows that 62.3% of the respondent's states that use of mechanized farming system this were as results of farmers using modern technology during farming practicing, it's however using of technological and innovative aids leads to high level of productivity. Furthermore, 53.2% of the wheat farmers postulate that famers using quality pesticide in the study area abstain their farm products against insect/pest manifestation. The main factors that influence the degree of efficiency are mechanized system of farming, the mode of improved seed, whether the farmer engages in full-time or part-time wheat farming, and, to a lesser extent, farm size and household size. Modern practices significantly increase the level of technical efficiencies of farmers. The age of the farmer and the years of wheat farming experience were strongly correlated and hence the model retained age of the farmer as the explanatory variable. This could be because most of the elderly farmers continued to utilize certified seeds which they preserved from their best crop.

Table 6: Distribution of Respondents According to Factor Responsible for Efficiency in Wheat Farming

Variables	*Frequency	Percentage
Use of Modern Practice	99	64.3
Use of Improve Seed	117	76.0
Adoption of Extension training	98	63.6
Use of Mechanized Farming System	96	62.3
Use of Quality Fertilizer	99	64.3
Use of Quality Pesticide	82	53.2
Farm Size	55	35.7
Household Size	40	26.0
Farming Experience	66	42.9
Sex	24	15.6

Source: Field Survey, 2021

**Multiple Response*

Cost and Return Analysis

Information on costs and return components of wheat production in the study area is presented in Table 7. The total cost is made up of “variable” and “fixed” components. The study showed that the total cost of wheat production per hectare was ₦35,037.00. The variable cost includes farmers’ expenditure on labour, seeds, fertilizer and herbicide, while the fixed cost was limited to depreciation on durable items such as hoes, rakes, cutlasses and axes. Also, 86.13% and 2.85% constituted cost components of variable and fixed items respectively with labour contributing the highest proportion of 40.77%. However, land, seed, fertilizer and herbicide constituted 28.54%, 2.85%, 21.40% and 6.42% of the total cost of wheat production in the study area respectively. In terms of revenue, the sum of ₦85,750.00 was realized from the sales of 1.15 tonnes of wheat obtained per hectare per season. The gross margin was ₦50,713.00 and the return per naira invested was ₦1.53. This implies that wheat production was profitable in the study area, in sense that, for every ₦1.00 invested, ₦1.53 were realized as net profit. This result corroborates with the results obtained by Mbanasor and Kalu (2018). However, wheat production is a profitable venture and worth undertaking.

Table 7: Costs and Returns Components of the Wheat Farmers

Variable	Amount (₦)	Percentage
Land	10,000.00	28.54
Labour	14,287.00	40.77
Seed	1000.00	2.85
Fertilizer	7,500.00	21.40
Herbicide	2,250.00	6.42
Total Variable cost	35,037.00	86.13
Output	10,000.00	
Fixed costs		
Depreciation cost		
Farm tools	1,000.00	2.85
Total cost	56,037.00	100
Output	10,000.00	
Returns		
Sales of Wheat	45,000.00	
Crop residue	5,250.00	
Home consumption	35,500.00	
Total revenue	85,750.00	
Benefit cost		
Gross Margin	50,713.00	
Return per Naira Invested	1.53	

Source: Field Survey, 2021

Maximum Likelihood Estimate of Stochastic Production Frontier of Wheat Farmers

The result as presented in Table 8 indicated that production efficiency in the study area was found to be 52 %. The farmers were 48% inefficient with their production of wheat. The result of stochastic production frontier revealed application of quality fertilizer was significant at ($p < 0.01$), access to human labour ($p < 0.01$), and adequate herbicides ($p < 0.05$) significantly influenced wheat production while farming experience ($p < 0.01$)

significantly influenced production efficiency of the wheat farmers. The coefficient of fertilizer application (kg/ha) revealed that increase by 1%, will increase production by 0.126 %. The coefficient of Human labour (hrs/ha) revealed that increase in it by 1%, will increase production by 0.613 %. The coefficient of herbicide (kg/ha) revealed that increase in it by 1%, will increase production by 0.218%.

The sign of the coefficients of the inefficiency variable has important policy implications since the positive sign implies a negative effect on technical efficiency, and the negative sign implies a positive effect on efficiency. The positive coefficient of Farmers age revealed that the technical inefficiency of wheat farmers increased with age, meaning farmers got less efficient as they got older, ($p > 0.05$), this was not significant. The negative coefficient of farming experience revealed that the technical inefficiency of wheat farmers increases with more experience, meaning farmers got more efficient as they got more experience ($P < 0.01$) this was deemed a significant effect.

According to Mulwa (2019) the inefficiency model estimated coefficients of education, family size and landholding size confirmed to the a priori expectation. A negative coefficient in efficiency model shows the positive effect on efficiency i.e. it increases the technical efficiency and production, while a positive sign indicates negative impact on efficiency i.e. decreases technical efficiency, resulting in decrease in production of wheat. The coefficient of age was found to be 0.012 and significant at 5% of probability level. This implies that there is positive relationship between age and technical inefficiency in wheat production i.e. as the age increases, the efficiency declines. Age of the cultivators play an important role in decision making and has contribution towards cultivators general learning and right judgments in time. This reason for this relationship may be due to the fact that old age farmers may be unwilling to take risk and their thought may be traditional. The other cause may be to evade frequent experimentation with the new advent of technologies.

Table 8: Maximum Likelihood Estimate of Stochastic Production Frontier of Wheat Farmers

Variable	Coefficient	Standard Error	T-value	P-value
Constant	4.12	0.14	29.428	0.000***
ln (Seed) (X_1)	0.46	0.24	1.9167	0.0571
ln (Fertilizer) (X_2)	0.126	0.04	3.15	0.00196***
ln (Human Labour) (X_3)	0.613	0.18	3.4056	0.00084***
ln (Herbicide) (X_4)	0.218	0.1	2.18	0.03077**
Inefficiency Model				
Age (Z_1)	0.032	0.12	-0.2667	0.79008
Income Generation (Z_2)	-0.125	0.09	1.3889	0.16687
Farming Experience (Z_3)	-0.789	0.23	3.4304	0.0077***
Wald $\chi^2(4)$	1113.36***			
Prob> χ^2	0.0000***			
Log-likelihood	-241.176			

Source: Field Survey, 2021 *, **and ***

Farmers Constraint on Wheat Production

The result in Table 9 shows the constraints faced by wheat farmers. The findings revealed that majority (74.8%) of the wheat farmers agreed that high cost of inputs was the main constraint faced by the farmers. While 70.2% of the respondents agreed that there was



poor quality of seedlings in the study area. Furthermore, the study revealed that 59.6% of the wheat farmers agreed that there was poor road network similarly; Inoni and Omotor (2017) also indicated that poor road quality reduces the income of farm households. The implication of this is that farmers need an urgent intervention from government and stakeholders in terms of construction and rehabilitation of roads so as to improve the livelihoods of the farmers through the privilege of transportation of produce to more buoyant markets in good condition and at less cost. The table shows that 49.0% of the wheat farmers states that there was inadequate labour source during the production period farm laborers are insufficient in the study area to be hired. Hence, 48.3% and 47.0% of the wheat farmers stated that limited access to financial services and limited access to inputs where also a factor that lead to challenges faced by the farmers in the study area. According National Commission on agriculture (2018), diagnosed lack of credit as some major constraint towards adoptability of modern techniques and inputs, particularly for small scale farmers. It is also identified that larger farmers are the main beneficiaries of the credit facilities offered by the banking institutions.

Table 9: Constraint on Wheat Production (n=154)

Constraints	*Frequency	Percentage
limited access to input	71	47.0
high cost of inputs	113	74.8
poor quality of seedlings	106	70.2
inadequate farmland clearing	69	45.7
poor road network	90	59.6
limited access to financial service	73	48.3
inadequate labour sources	74	49.0
high cost of agro chemicals	60	39.7
inadequate credit facilities	67	44.4
inadequate of extension services	20	13.2

Source: Field Survey, 2021

**Multiple Response*

CONCLUSION AND RECOMMENDATIONS

The findings of the study indicated that adoption of improve seed, use of modern practice and use of quality fertilizer will ensure technical efficiency among the wheat farmers and also wheat production can be increased significantly by adopting a number of measures. Application of quality fertilizer, access to human labour and adequate herbicides significantly influenced wheat production while farming experience significantly influenced production efficiency of the wheat farmers. The study recommends that agricultural finance institutions should focus on provision of credit for purchase of equipment and farm inputs. This can be done through farmers' cooperatives and other organizations at the local level. The study established that farmers indicated that shortages and high costs of fertilizer were a major limitation to their productivity. The Ministry of Agriculture, through the National Cereals and Produce Board, should import and distribute fertilizers to depots within the vicinity of farmers and introduce a price cap on the costs.

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