

# Profitability and Productivity Analysis of Tractorised and Non-Tractorised Maize Production in Lere Local Government Area of Kaduna State, Nigeria

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**Abstract:** In the recent time, reducing food insecurity and poverty is now regarded by many as the most important goal of the twenty first century. To achieve this laudable objective requires removal of drudgery associated with farming and improve productivity. This study compares the profitability and productivity of tractorised and non-tractorised maize farmers. Purposive and random sampling techniques were used to select eighty (80) maize farmers for the study. The result revealed that majority of the respondents was male. In addition, (85%) and (80%) of the tractorised and non-tractorised respectively have formal education. Based on their farm size majority (60%) of the manual farmers cultivated between 2.1-3.0 ha while (50%) of the tractorised cultivated between 4.1-5.0 ha. Furthermore, the net farm incomes for the tractorised and manual maize farmers were found to be ₦310, 100.00 and ₦ 127,950.00 naira respectively. The total labour and capital productivity for the mechanized farmers were higher than that of their manual counterparts. Nevertheless, there were many constraints militating against the production of this staple food crop in the area, thus the respondents perceived inadequate capital as first(1<sup>st</sup>), poor producer price and high cost of inputs were ranked second (2<sup>nd</sup>) and third(3<sup>rd</sup>) respectively. In other to improve productivity and output the study recommends the need to subsidize the cost of acquiring farm machineries especially tractors by the government, price control of farm inputs and provision of production loans to the maize farmers at low interest rate to facilitate speedy adoption of mechanization.

**Key words:** Profitability, Productivity, Tractorised and Non-tractorised, Maize Production.

## I. INTRODUCTION

Production of *Zea mays* has become very popular crop widely grown in many countries of the world. It can be stored for long period than other crops like root crops mainly due to its low moisture content. It has lower seeding but higher multiplication rates (i.e it has the advantage of high yield relative to the seed plant) and the impact of seed stock depletion does not affect its demand in subsequent years (Hiroiyuki and Salau, 2010).

According to Oni and Ikpi (2001), reducing poverty is now regarded by many as the most important goal of human development. Indeed, it is now widely accepted that, development must be about improvement of human wellbeing, removal of hunger, removal of drudgery associated in farming and improve productivity which is possible with

the adoption of mechanization, thus mechanized farming will in no small measure help to increase income of the rural dwellers and thereby reduce the rural region income differential and associated rural-urban drift will be eliminated with increased per capita income. It is widely recognized that the use of appropriate modern technologies will help to increase output to enhance poverty reduction in Nigeria, however the present technologies has not really made the desired impact in improving the living standard of farmer. This could be as a result of non-adoption or slow rate of use of the modern technology among farmers (Singh and Fashola, 2000, Aasa *et al.*, 2015).

An understanding of seed supply system and factors currently limiting the production and deployment of improved certified maize seeds in Sub-Sahara Africa (SSA) is therefore of paramount importance in promoting maize production, improving farmers' income, alleviating poverty, ensuring food security. Hence, farmers may subjectively evaluate the technology differently from agriculture researchers (Johnson, 2002).

Poverty and food insecurity are major problems affecting our society. Okorji and Enem (2007) noted that one of the way of reducing poverty and hunger in the society is by ensuring food security. With the present urge to expand food availability, human drudgery alone can no longer feed Nigeria growing population hence farmers need to go mechanized or the food production will continue to fail to keep pace the population growth. To solve the problem of hunger, Raham and Lawal (2003) observed that there is a need to embrace farm mechanization which guarantees large volume of production capacity in maize production and farming in general. In view of this, this study was carried out to achieve the following objectives: describe the socio- economic characteristics of the maize farmers in the study area, examine the differences in the costs and returns in the production of maize by the tractorised and non-tractorised maize farmers, determine the profitability and productivity index of tractorised and manual maize farmers and discuss the constraints associated with maize production in the area

## II. LITERATURE AND CONCEPTUAL FRAMEWORK

Agriculturists have been challenged to find ways to boost Nigeria's maize production to meet the growing demand. One way to increase the domestic supply to meet the demand of the populace is to employ production resources more efficiently (Alabi, *et al*, 2005). Profitability and productivity of agricultural farms are two related but distinct concepts. They are related in the sense that a more productive business typically is also more profitable and a faster profitability often translates into faster growth in profitability (Islam *et al.*, 2011). Islam *et al* (2011) observed that the main contribution to farm profitability is growth in total factor productivity. The relationship between productivity and profitability is not linear which makes it difficult to decompose variation in profitability into variation in productivity and efficiency. Ha, strappazon and Fisher (2001), further explained that productivity and profitability concepts are important when evaluating the health of farm as the two concepts analyse different aspects of performance. We can easily measure productivity when there is one output and one input. For example, "if the output is cassava, and input is labour". The measure of productivity could be kilograms of cassava per hours of labour. Productivity is usually measured as relative concepts either across farms or across times. Productivity as a concept can assume two dimensions. Total factor productivity (TFP) and Partial productivity. TFP measures the average product of all inputs. It takes into account all of land, labour, capital and material resources employed in farm production (gross input) and compares them with the total amount of crop and livestock output (gross output). Gross output measure reflects how efficiently all inputs is combined to produce total output.

The word 'profitability' comprises of two words, namely, profit and ability. Profit is the difference between the total gross income from a venture and how much it has cost to produce and market the product. Profit is sometimes called 'Return' and on other occasions. It is referred to as 'Margins'. Margin is however, more commonly used for a ratio than for an amount. The term 'ability' indicates the power of a firm or enterprise to earn profits. Profitability may be therefore, defined as the ability of a given firm to earn return. It shows how efficient the management can make profit by using all the resources available in the market. According to Hofstrand, (2009) measuring current, past and future profitability is very important. Enhancing productivity and profitability of certain crops and livestock in Nigeria could lead to substantial improvement in the standard of living of the agrarian society and reduction of poverty. Agriculture accounts for an estimated 56% of Kaduna state GDP and employs approximately four (4) million people. The state produces 22% of the country's maize and its arming populace constitutes over 75% of the state total population. The state has about 606,007 farming families with most farmers producing cereal crops such as Maize, Sorghum, etc (<http://www.kadunastategovernment.ng>).

## III. MATERIALS AND METHOD

### A. Study Area

The study was conducted in Lere Local Government Area of Kaduna State. According to Malami (2017), its headquarter is located in Saminaka. The Local Government Area was created in the year 1991 out of the former Saminaka Local Government created in 1976. The Local Government is located between Latitude 9<sup>0</sup>N and 12<sup>0</sup>N and longitude 6<sup>0</sup>E and 9<sup>0</sup>E of prime meridian. The total land area is about 21,158km<sup>2</sup> and a population of 331,161 as at the 2006 census (NPC, 2006). It shares boundary with Kano state in the northern part, while in the area towards eastern part it is bounded by Bauchi and Plateau states. These without any doubt are important cities that have contributed immensely to the development of economic activities especially agricultural production in the country. In addition to the above mentioned, other important area around Lere local government include the ancient city of Zaria to the north. It is bordered by the commercial town of Kafanchan down south. The study area has many villages among which are Lere, Saminaka, Kayarda, UngwanBawa, Yarkasuwa, Garu, Gure, Dokandanbala, Lazuru e t c. The climate in Lere local government can be divided into three sections, these start with the hot and sunny area beginning from February to early May, followed by the raining season which from March will signal the farmers to clear up their farmlands, while serious full farming activities begins from June, when rain also start in earnest and comes to an end in October. It is immediately followed by harmathan season, which usually last for about three months and this is followed by about four months of dry season. Crops commonly grow in the area include maize, yam, millet, beans, soya beans, tomatoes, onion, sugar cane, rice, groundnut, cucumber, cabbage and potatoes. Based on the record the Local Government Area has been among the highest Local government in Kaduna State which Contributed in feeding the Nation (Malami, 2017)

### B. Sampling Technique and Data Collection

The sampling populations were the eighty (80) maize farmers comprising of forty (40) tractorised and forty (40) non tractorised farmers. The former were purposively selected in order to ensure that only those that performed the two out of three tractorised operations were selected while random technique was employed to select the manual farmers from the following villages/ towns; Saminaka, Lere, UngwaBawa, Yarkasuwa and Kayarda. Based on the population and concentration of the maize producers in these places, 20 respondents each were selected from Saminaka and Lere while 16 respondents each were selected from Kayarda and UngwaBawa and 8 respondents from Yarkasuwa. Primary data used for the study was collected based on the 2018/2019 cropping season through the use of structured questionnaire which was administered to the farmers to elicit information on their age, educational status, household size, farm size, farming experience) and production variables which include the following; land area cultivated (ha), labour ( in man day),

inputs namely seeds, fertilizer, organic manure and quantity of output realize (kg)

### C. Analytical Technique

Descriptive statistics such as measures of central tendency such as mean, frequency distribution, percentages and measures of dispersion such as ranking and ratio were employed to achieve objective 1 and 4.

1). *Budgeting Technique*: The net farm income was used to determine the cost and returns of maize production. This was employed to achieve objective 3, the gross margin (GM) per hectare for an enterprise was given by the equation;

$$GM = GR - TVC$$

i.e. Gross margin = Gross returns – Total variables cost

Net farm income (NFI) = Gross Margin (GM)-Depreciation of the fixed inputs. In this study land rent and interest on loans constitute the fixed input.

Net Income was calculated by using the formula below:

$$NFI = TR - TC$$

where, TC= Total cost (TVC plus TFC), TFC= Total Fixed Cost such as cost of land etc, TVC= total variable cost such as cost of land preparation, cost of seed and other inputs, etc

### 2). Profitability Index Measures

i. *Gross Ratio*: is given as total Farm Expense (TFE) divided by Gross income (GI)  $GR = TFE \div GI$

ii. *Operating Ratio (OR)*: is given as Total Operating cost (TOC) divided by Gross Income (GI) i.e.  $OR = TOC \div GI$

iii. *Return per capital invested (RPCI)*: is given as NFI divided by TR i.e.  $RPC = Net\ farm\ Income \div Total\ Revenue$

iv. *Benefit Cost Ratio (BCR)*: this is given as benefit divided by cost i.e.  $Benefit\ (TR) \div cost\ (TC)$ . This ratio shows whether a business is worth investing in or not. That is, if the ratio is greater than 1 it is profitable and otherwise if it is less than unit. The profitability ratio implies that for every one Naira (₦1) invested in the production will give a return of the value spent.

3). *Productivity Analysis*: The following index was estimated.

Total productivity = Total value of product (₦)/ total value of input (₦)

Labour productivity = Total value of product (₦)/ total value of labour (₦)

Capital productivity = Total value of product (₦)/ total value of capital (₦)

## IV. RESULT AND DISCUSSION

### A. Socio-Economic Characteristics of the Respondents

The socio-economic characteristics of the respondents examined include; age, level of education,

household size, etc. Table 1 shows that majority (37.50%) and (42.50%) of manual and mechanized maize farmers were 41-50 years respectively. These age groups are economically active in maize production in the study area. This agreed with the findings of Aasa, et al (2011) who stated that farmers within this age group were considered active and perhaps eager to use new innovations that will enhance their production and income.

On the basis of gender (87.50%) manual farmers are male while (92.50%) men are involved in tractorised maize farming. Furthermore, the table shows that (37.50%) and (35.00%) of mechanized and non-mechanized farmers had senior and junior secondary education respectively. This means that they both have the ability to read and write. This implies that maize farmers were educated and they know the economic importance of maize and thus, the need to employ modern technology to increase their output to meet its demand in our country.

In addition, (30.00%) of the tractorised farmers had been involved in maize production for about 6 to 10 years, while (70.33%) and (13.33%) non-tractorised farmers and tractorised counterpart respectively had above 31 years farming experience. This shows that majority of the manual farmers had long years of experience in production of maize. On the basis of farm size, majority (60.00%) of the manual farmers cultivated between 2.1-3.0 hectares while majority (50.00%) of the mechanized farmers cultivated between 4.1-5.00 ha. Hence, we will not be wrong to conclude that most members of the tractorise maize farmers are medium scale, according to FMR&WR (2008) stated that medium scale farmers are those that cultivated between 3.0- 5.0 ha. There are many types of labor employed by the farmers in the study area these include; family, hired and joint labor. Table 1 further showed the type of labor employed by the farmers; family labor has (40.00%) and (60.00%) among the mechanized and manual farmers respectively. This shows that most of the farmers used the members of their families for the production of maize. Members of the farmers' household constitute family labor which most of the farmers usually employ. This findings agree with Aasa (2006) in his study on "analysis of factors affecting the marketing and demand for certified maize seed in Kaduna state" The total amount of labour used per hectare on non tractorised farms was 100.10 man day per hectare while for the tractorised farms was 64.93.

The Table also indicates how the farmers acquire the money for the production of maize. (40.0%) and (30.0%) of the tractorised and manual got loans from cooperative societies respectively while (60.0%) of the manual farmers make use of their savings. Thus, personal savings has the highest percentage. This shows why majority of the respondents have small farms. On the basis of yield obtained per hectare, (55.0%) and (50.0%) of the manual and mechanized maize farmers obtained 11-20 bags and 31-40 bags of maize from their farms respectively. However, none of the respondents obtained amount of yield as claimed by the seed farms and

researchers. This may be attributed to the fact that majority of the respondents did not plant the recommended seed rate and apply recommended fertilizer rate per hectare, etc. This agreed with the findings of other researchers such as Aasa, *et al* (2015). It was observed that many of the manual farmers planted one seed per hole this is because of the high cost of hybrid seed.

#### B. Cost and Return

This section examined all the variable cost expended by the farmers in order to determine the profitability of maize in the study area; this is summarized in Table 2. The production cost and returns analysis revealed the cost incurred and the revenue generated by the respondents in the study area. The revenue generated was made up of sales from the harvested product. The various cost incurred on the different

resources used and the revenue obtained from sales were based on the prevailing market price of maize as at the period of the survey. Since the manual farmers are mostly small scale, their fixed cost was small, however cost of land assumed to be rented was considered.

The average total revenue from one hectare in the study was found to be ₦461,250.00 and ₦194,750.00 naira for mechanized and manual maize farmers respectively and the total variable cost was also found to be ₦147,150.00 and ₦62,800.00 naira for mechanized and for manual farmers respectively. From the foregoing, it is very clear that the cost of hiring tractors in the study area is very high as it the total variable cost incurred by the tractorised farmers is more than twice that of their manual counterpart. Thus, the NFI was ₦310, 100.00 and ₦127, 950.00 naira for the mechanized and manual farmers respective

Table 1.Socio-economic characteristic of the Respondents

CHARACTERISTICS	Tractorised Farmers		Manual, Farmers	
	Frequency	Percentage	Frequency	Percentage
Sex				
Male	37	92.50	35	87
Female	3	7.50	5	12.50
Age (years_				
21-30	10	25.00	3	7.5
31-40	6	15.00	16	40.00
41-5-	15	37.50	17	42.5
51 and above	9	22.50	4	10.00
Farm Size (Ha)				
1-2	5	12.5	10	25.00
2.1-3	6	15.00	24	60.00
3.1-4	9	22.3	6	15.00
4.^-5	20	50.00	-	-
Level of education (Yrs)	9	22.50	4	10.0
Primary	6	15.00	14	36.00
Junior Secondary School	15	37.5	1.0	25.00
Tertiary	4	10.00	4	10.00
Quranic	6	15.00	8	20
<b>Total</b>	<b>40</b>	<b>100</b>	<b>40</b>	<b>100</b>
<b>Farming Experience (yrs)</b>				
5-10	4	10	2	5.00
11-15	20	50	20	50
16-20	6	40	12	30
Greater than 21	10		6	
<b>Source of Labour</b>				
Family	16	40	24	60
Hired	24	60	16	40



Source of Finance				
Cooperative	16	40	12	30
Commercial Bank	8	20	4	10
Personal savings	20	50	24	60
Friends	10		-	-
Quantity of yield(bags)				
10-20	6	15	22	55
21-30	12	30	10	25
31-40	20	50	4	10
41-50	2	5	4	10
Total	40	100	40	100

SOURCE; Field Survey 2018

**Table 2;** Cost and Returns Analysis

ITEMS	Mechanized Cost (N/ha)	Manual Cost (N/ha)
<b>Variable input</b>	5000	4000
Land Clearing	5000.00	5,000.00
Ploughing	21,500.00	-
Harrowing/Ridging	25,000.00	-
Labor	11,000.00	7,500.00
Seed	34,000.00	20,000.00
Fertilizers	29,,600.00	14,9000.00
Harvesting and processing	15,250.00	7,500.00
Herbicides	5,400.00	7,500.00
<b>TVC</b>	147,150.00	62,800.00
<b>GM</b>	341,100.00	131,950.00
Fixed Inputs		
Rent	2000.00	2000.00
Interest	2000.00	2000.00
TFC	4000.004000.00	
Total Cost	151,150.00	66,800.00
Yield Kg/ha	45 bags	19 bags
Total Revenue	10,250.00	461,250.00
Net farm income	310,100.00	127,950.0000

SOURCE ; Field Survey 2018

### C. Profitability Analysis

For the analysis of profitability ratios, the result as presented in table (iii) revealed that the gross ratio was 0.33 and 0.34 for the mechanized and manual farmers respectively. This shows that the total farm cost was (33.0%) and (34.0%) of the gross income (GI) for the mechanized and manual farmers respectively. And this is desirable for any farm business. According to Olukosi and Erhabor (2008), the lower the ratio the higher the return per naira invested. Also, operating ratio indicated that (32.0%) of the gross income

(GI) goes into the variable inputs used in the production of maize by the tractorised farmers in the study area. The financial viability of maize production was performed using the return per capital invested and Benefit-Cost ratio. The Return per capital invested (RPCI) was the same (0.67) for both groups. This means that for every naira invested by the producers, 67 kobo was gained. On the other hand, the B-C ratio was 3.05 and 2.91 for the mechanized and non-mechanized farmers respectively. Three profitability ratio estimated show that tractorised farms are not more profitable than manual farms. This means that tractorised maize farmers are not more technically efficient than their manual counterpart. However, the B-C ratio for the tractorised farms (3.05) was higher than the manual farms (2.98).

### D. Productivity Analysis

The total productivity and capital productivity for the tractorised farmers was a little higher than that of the non-tractorised farmers while the labour productivity was 69.30 for the former and 18.98 for the latter. This implies that tractorisation is labour efficient. Thus, the fact that total, labour and capital productivity ratio were higher for tractorised farms, this implies that tractorised farms are technically more efficient than the manual farms. This corroborates the clamour for the adoption of mechanisation in our country, as it has the potential to improve and increase efficiency of resources.

### E. Constraints Affecting Maize Farmers in the Study Area

It is well known fact that agricultural production in our country is facing series of problems (Aasa, 2006). Thus, this study examined some of the constraints hampering the production of maize. A list of perceived constraints militating against maize production were provided for the respondents to rank in order of most serious so on depending on it magnitude of its effect on their production. The result revealed that inadequate capital was ranked first by 69 respondents and is the most serious constraint. Poor producer price and high cost of inputs were ranked second and third respectively. . On the other hand, climatic problems such as flood, etc d inadequate

extension services and lack of market information were ranked ninth and tenth implying that the later posse less constraints to the farmers compared to capital, poor price and high cost of farm inputs.

Table3; Profitability index

Index	Mechanised	Manual
Gross Ratio (GR)	0.33	0.34
Operating Ratio	0.32	0.32
RPCI	0.67	0.66
Benefit Cost Ratio (BCR_	3.05	2.01

SOURCE; Computed Field Survey 2018

Table 4; Productivity Ratio

Productivity	Mechanised	Manual
Total Productivity (TP/TC)	0.03	0.03
Labour Productivity(TP/value of labour)	69.30	18.98
Capital Productivity(TP/value of Capital)	3.29	3.28

SOURCE; Computed Field Survey 2018

Table 5: Constraints Facing Maize Farmers in the Study Area

Constraints	Frequency	Cumulative Frequency	Ranking
Inadequate Capital	69*	434	1 <sup>st</sup>
Poor Price of Farm Produce	67*	365	2 <sup>nd</sup>
High Cost of farm inputs	60*	298	3 <sup>rd</sup>
Farm Destruction by Cattle	55*	238	4 <sup>th</sup>
High Storage Losses	48*	203	5 <sup>th</sup>
Lack of processing facilities	45*	155	6 <sup>th</sup>
High Cost of Transportation	38*	110	7 <sup>th</sup>
Climatic problems e.g. flood	30*	72	8 <sup>th</sup>
Inadequate Contact with Extensionists	22*	42	9 <sup>th</sup>
Inadequate Market Information	20*	20	10 <sup>th</sup>

\*Multiple Response

## V. CONCLUSION AND RECOMMENDATIONS

The result of this study shows that generally, maize production is highly profitable, nonetheless tractorised maize production is more profitable and efficient than manual . However, this staple food crop could not be produced on a large scale as it supposed to be by the majority of the rural families as a source of income and food security venture, this is due to the fact that there were a lot of bottlenecks militating against higher production of this major food crop. They include: high cost of hiring tractor, poor price and unstable price, inadequate capital, lack of education, lack of extension agent, lack of equipment for processing and storing the crop. From the findings of this research, the following

recommendations were put forward; (i) there is a need to subsidize the cost of hiring tractor in the area in order to encourage more farmers to be able to afford this modern way of farming, this will go a long way to make farming attractive to the teaming youth in the area who are been drifting to the urban areas.

(ii) There is a need for price control for farm inputs such as cost of hybrid seed, fertilizer, just to mention but a few which always skyrocketed particularly during the planting season and to a large extent scarce, moreover the price of a bag of maize should be raised in accordance with the prevailing market price of other commodities. This will encourage the producers to produce more and other farmers to produce maize.

(iii) The government should ensure that financial institutions (commercial banks) should endeavor to provide loans at low interest rate to the farmers so as to improve their production capital. This will assist the farmers to embark on large scale production of maize in the study area. Suffice to say that the government intervention in rice production by the Central Bank of Nigeria (CBN) should therefore be extended to the maize producers as well.

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