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RESOURCE USE EFFICIENCY IN BARLEY PRODUCTION IN BORNO STATE, NIGERIA

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Abstract

The study estimated resource use efficiency in barley production in Borno State, Nigeria. Data were collected with the aid of a structured questionnaire. Multi-stage sampling procedure was employed. In the first stage, two (2) senatorial zones were randomly selected. These are central and northern senatorial zones. In the second stage, two local governments were purposively selected from these zones. These include Ngala and Marte while in the third stage, 500 barley farmers were randomly and proportionately selected and used for the analysis. Descriptive statistics and production function model were used as analytical tools. The finding shows that 36% of the respondents were within the age group of 31-40 years, majority 80% were male, 28% had secondary education. The finding also reveals that 12% of the respondents cultivated less than two (2) hectares of land, 48% earned N301, 000 - N600, 000 as annual farm incomes and 38% had between 16 – 20 years of experience in farming in the study area. The total sum of elasticities of the resources was 0.966. The finding shows that inputs such as seed, farm size, chemical, hired labour, family labour, fertilizer and mechanized labour were over- utilized by barley farmers in the study area. It was recommended that: farmers should form agricultural cooperative groups that will enable them obtain credit from government and financial institutions and efficiency in barley production could be achieved through the decreased use of land, improved seed, fertilizer etc.

Keywords: Resource Use Efficiency, Barley Production, Farmers, Senatorial Zones, Borno State, Nigeria

INTRODUCTION

Before the discovery of oil, agriculture was the key area contributing to the Nigeria economy. It was the main source of foreign exchange earnings and accounted for over 60% of its Gross Domestic Product (GDP) in the 1960s (Tijani, Tijjani and Tijjani, 2015). In 2017, the contributed of agriculture was around 20.85% to Nigeria's GDP (Nigeria Data Portal, 2015). The shares of agricultural products both processed and unprocessed were high far back then. Agriculture plays an important role in the economic development of Nigeria. It provides food for the growing population, employment for over 65% of the population and raw materials and foreign exchange earnings for the development of the industrial sector (Alabi and Esobhawan, 2006). However, the ability of Nigerian agriculture to perform its roles in development has been on the decline in the last two decades (Alabi and Esobhawan, 2006). Agricultural outputs started to decline rapidly in the 1970s which coincided not only with the end of Nigeria civil war, but also the oil boom and severe draught of 1972 – 1973 (Alabi and Esobhawan, 2006).

The overall agricultural situation deteriorated creating wide gap between demand and supply for food. Revenue from the agricultural sector dwindled and the government was faced with mounting food import bill (Alabi and Esobhawan, 2006). At the same time, industries continued to import agricultural raw materials thus, putting considerable stress on Nigeria's foreign exchange earnings. It was against this background of a rudimentary economy, but abundantly – endowed with human and natural resources, that Nigerian government adopted different agricultural programmes and policies at raising the productivity and efficiency of agricultural sector (Alabi and Esobhawan, 2006). The programs policies placed the small holder farmer in central focus. This was due to the fact that nation's agriculture had always been dominated by small holder farmers who represent a substantial proportion of the total farming population and produce over 90% of the total agricultural output in the country. They produce barley, millet, sorghum, yam, plantain, sweet potato etc. Grains produced in Nigeria are maize, rice cowpea, soybean, barley, sorghum, millet and groundnut.

Barley production in the European Union (EU) was down from last year's level. Dryness in Western Europe and witness in Eastern Europe were unfavourable for 2010/11 yields (United States Department of Agriculture (USDA), 2010). While grain quality was generally high in France and the United Kingdom (UK), output was down as attributes were influenced by the lack of rainfall during the summer. Barley production in the EU was estimated at 53.6 million tons, down 0.7 million from last month and down 8.1 million tons from last year (USDA, 2010). Area estimated at 12.5 million hectares, down 0.1 million from last month and down 1.4 million from last year (USDA, 2010). Estimated yield is revised to 4.29 t/ha compared to 4.44 t/ha last year (USDA, 2010). Specifically, barley was down 0.4 million tons and 0.1 million hectares in

Spain and 0.2 million tons in Poland from last month's estimate (USDA, 2010). Sown areas were significantly reduced in 2010 because of low prices at planting time. In Nigeria, yield of about 2,250kg, 1,100kg and 1,200kg per hectare were recorded for Aropo5 variety in 2005/2006, 2006/2007 and 2007/2008 production seasons respectively (Lake Chad Research Institute (LCRI), 2008). Similarly, 1,500kg and 1,300kg per hectare were recorded for Amapa5 variety in 2005/2006 and 2006/2007 respectively, while 0.2kg per hectare was recorded in 2005/2006 for Ketch variety (LCRI, 2008). Barley is the most recent grain to be excluded from the EU's intervention storage and much of its area was shifted in to higher priced crops like wheat Barley areas for France, Germany, and Spain are down from last year by 0.2 million hectares for each country and by 0.3 million hectares for UK (USDA, 2010).

Barley is one of the important food crop grown in Borno state and in Nigeria as a whole, grown mainly by small farmers. The reality is that Nigeria has not been able to attain self – sufficiency in food production despite increasing hectares put into production annually (Central Bank of Nigeria (CBN), 2000). Barley scheme is neither large, nor has it been widely publicized, but it was representative of a new phase in Africa and, most significantly, Nigeria agriculture. In particular, first, the scheme was directed to producing a crop for which demand has been stimulated explicitly the imposition of the import restrictions introduced at the same time as a structural Adjustment programme (SAP). Secondly, the aim of the scheme was to obtain at least part of the crop through contractual arrangement with small scale peasant farmers. The local context of the schemes added additional dimensions of interest. The barley is being grown on industrial waste land, in the former tin mining of the Jos Plateau of Nigeria, in some cases utilizing water from the abundant mine ponds and the labour of former mine workers. It appears moreover, to be the first attempt at commercial barley production in Nigeria.

The government's announcement in April 1987 of total ban on barley malt import was a sever shock to brewers who had only limited trials with malted sorghum (Porter and Phillips-Howard, 1994). It brought forward an earlier agreement to phase out brewing imports by two years. The ban came into effect on first January 1994 and was affected save hundred millions of naira in foreign exchange (Porter and Phillips-Horward, 1994). Brewers were expected to use malted sorghum, instead of imported barley, which is traditional source of malt for brewing larger beer. Despite the brewers' argument that they contributed up to N1 million per annum in government revenue, the government refused to rescind the ban. In the 1980s decline in oil prices and massive foreign debts forced the government to make drastic changes in policy, under its structural adjustment programme (SAP's) introduced in 1986 (Porter and Phillips –

Horwards, 1994). This domestic programme – unlike standard IMF – imposed SAP was accompanied by bans on a range of food import. Rumors of a possible ban on imported barley came as early as 1984, when government introduced a programme of import substitution (Porter and Phillips – Horwards, 1994). Government exhortations to industry to develop local sourcing were initially side stepped through stockpiling, while making efforts to achieve local supplies.

Efficiency studies helps in understanding the existing performance and opportunities to improve the production performance of a particular enterprise under consideration (Tijani, Tijjani and Tijjani, 2015). Farmers can improve agricultural production by considering several alternatives such as implementation of modern technology, intensification and better utilisation of the available inputs (Kamau, 2019). The constraint to the rapid growth of food production seems to be mainly that of low crop yields and resources productivity. The low agricultural productivity in Nigeria is revealed by the actual yields of major crops such as millet, barley, rice, sorghum etc compared with potential yield's (Federal Ministry of Agriculture, 1993). The implication is that there is scope for additional increase of output from existing hectares of barley, if resources are properly harnessed and efficiently allocated. Hence, this study becomes crucial in examining the resources used efficiency of farmers in barley production since increased output productivity are directly related to production efficiency (Amaza and Olayemi, 2002).

The choice of Borno State is premised on the fact that it is one of the largest barley producing areas in the region due to the location of Chad Basin Development Authority (South Chad Irrigation Project (SCIP) Phase I). There is dearth of information on resource – use efficiency in barley production in the study area to the knowledge of the researcher. It was against this background that this study was conceptualized to analyze the efficiency of resource – use efficiency in barley production in Borno State, Nigeria to bridge the gap in existing literature on resource – use efficiency in barley production research in the study area. The study attempts to provide answers to the following research questions: (i) what are the socio-economic characteristics of the respondents? (ii) are resources efficiently utilized in barley production?.

Objectives of the Study

The main objective of the study was to estimate the efficiency of resources use in barley production in Borno State, Nigeria.

The specific objectives were: (i) examine the socio – economic characteristics of farmers; and (ii) determine the efficiency of resource use.

METHODOLOGY

Study Area

Borno State is one of the largest States in Nigeria, covering a total land area of 69,435 square kilometer, about 7.67% of the total land area of the country (Ministry of Land Survey Maiduguri, 2009). The State is located approximately between latitudes 10^0 02^0N and 13^0 04^0N and longitudes 11^0 04^0E and $14^0$$04^0$E (Ministry of Land and Survey, Maiduguri). It shares boundaries with Adamawa state to south, Gombe State to the South east and Yobe State to the east. It also shares international boundaries with the republic of Chad northwest and Cameroon to the southwest. According to the 2006 census figure, Borno State has a population of 4,151,193 people with a population density of approximately 60 persons per square kilometer (NPC, 2006). The State is presently structured into 27 Local Government Areas.

The State which is predominantly agranian and is characterized by three natural agro-ecological zones which includes the Sahel savannah in the extreme north, the Sudan savannah in the central part and the northern Guinea savannah in the southern part (Folorunsho, 2006). The climate of the area is characterized by dry and wet seasons. The wet season lasts from March to October while the dry season is from October to April. The average annual temperature is about 30^0C with maximum of 45^0C in March and a minimum of 15^0C during the dry harmatan season. The annual rainfall ranges from 400mm to 700mm in the north and 500mm to 900mm in the southern part (Folorunsho, 2000). The soil types are clay, sandy loam, clay loam, sandy etc. with common weeds such as sudan grass, spear grass pennisitum, gamba grass, striga spp, with herbs and shrubs. Major crops grown in the area include millet, sorghum, barley, groundnut, maize, wheat, cowpea, bambara nut etc. vegetables such as tomatoes, okra, onions, pepper etc. and livestock such as cattle, sheep, goats, camel, horse and donkey. The major occupations of the people in the area are farming, cattle rearing and fishing. The principal ethnic groups are kanuri, Shuwa/Arab, Bura and Margi, others include Fulani/hausa etc.

Sampling Technique

A Multi-stage sampling procedure was employed. In the first stage, two (2) senatorial zones were randomly selected. These are central and northern senatorial zones. In the second stage, two local governments were purposively selected from these zones. These include Ngala and Marte while in the third stage, 500 barley farmers were randomly and proportionately selected and used for the analysis.

Source and Method of Data Collection

Primary data were collected with the aid of a structured questionnaire designed and administered by the researcher to 500 barley farmers in the study area. Secondary information were obtained from journals, government publications and earlier studies. The questionnaire was used to collect information on inputs used and output obtained by the barley farmers, for both production and costs variables. The barley output data considered include the total value of the crop obtained by adding cash receipts from selling farm produces, plus those consumed in the household. While the inputs used data include land area under cultivation (ha), family and hired labour in man-days, quantity of fertilizer (kg), quantity of seed and mechanized labour (N). Data was also collected on the socio-economic variables such as age, farming experience educational level and household size.

Analytical Techniques

The analytical tools employed for this study include descriptive statistics and production function model. The descriptive statistics that were used include percentage and frequency. These were used to organize and analyze the socio-economic characteristics of the respondents to achieve specific objective (i). Production function model was used to determine the physical relationship between inputs and output obtained in barley production; and the coefficient of the double – log function (elasticity) was used to estimate efficiency of resources use to achieve objective (ii). The implicit form of the model is expressed as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e)$

Where:

Y = Output of barley (kg)

X_1 = Quantity of seed (kg)

X_2 = Farm size (ha)

X_3 = Herbicides/insecticide used (liters)

X_4 = Hired labour (No. of Mondays)

X_5 = Family labour (No. of Mondays)

X_6 = Fertilizer used (kg)

X_7 = Mechanized labour (N)

e = error term

Different functional forms were tried for the analysis. This includes; linear, semi log, double log and exponential functions, out of which the double log function was chosen and used to estimate the technical efficiency of resources – use in barley production. The choice of the best functional form (lead equation) was based on both statistical and econometric criteria (T-test, f-

statistics, R^2), number of significant variables and expectation of the signs of the coefficient. It was expected *a priori* that the coefficient of X_1, X_2, X_3, X_4 and X_5, would be positive, while those of X_3, X_4 and X_7, would be negative. Also farmers' resources use in barley production was expected to be efficient.

Determining economic efficiency of resources – use: The following ratio was used to estimate the relative efficiency of resources use (r):

$$r = \frac{MVP}{MFC}$$

Where:

MFC = cost of one unit of a particular resources while MVP = value added to barley output due to the use of an additional unit of input calculated by the price of input i.e. MPP_X, XP_x.

If

r = 1 resource is efficiently utilized

r = > 1 resources is under utilized

r = < 1 resource is over utilized

Economic optimum take place where MVP = MFC. If r is not equal to (1), it suggests that resources are not efficiently utilized. Adjustment could therefore be made in the quantity of inputs used and costs in the production process to restore r = 1. The elasticity of production which is the percentage change in input used to calculate the rate of returns to scale which is a measure of a firm's success in producing maximum output from a set of inputs (Coelli and Battesse, 1996).

EP = MPP/APP

Where:

EP = Elasticity of Production

MPP = Marginal Physical Product

APP = Average Physical Product

If:

ΣEP = 1: Constant return to scale

ΣEP = <1: Decreasing return to scale

ΣEP = >1: Increasing return to scale.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents examined include: age, gender, educational level, major occupation, farm size, annual farm income, educational level and

farming experience. Analysis of the finding in Table 1 shows that 36% of the respondents were within the age group of 31-40 years, while 8% were 50 years and above in the study area. The finding shows that most of the respondents were in their active and productive age group. The age of a farmer is very important factor because it can be used to determine the type of agricultural activities engaged by farmers. For instance in traditional agriculture younger farmers spend much time and carryout labour intensive farming activities than older formers (Tijani *et. al.,* 2010). The result further indicates that majority 80% of the respondents were male, while 20% were female in the study area. The finding indicates that majority of the farmers in the study area were male. This suggests that male farmers have many mouths to feed in their households as heads. They therefore, engage more in farming to supply household food and other basic needs. This supports the finding by Tijani (2007) that majority of the respondents 77.5% 80.0% and 75.5% engaged in millet, sorghum and groundnut production in Borno state, Nigeria were male, while only 22.5% 20.0% were female. Gender is a significant factor in agriculture because of its vital role in determining the farmers' agricultural activities.

Table 1: Socio-economic Characteristics of the Respondents

Socio – economic variables	**Frequency**	**Percentage**
Age (years):		
Less than 30	130	26
31-40	180	36
41-50	150	30
50 and above	40	8
Total	**500**	**100**
Gender:		
Male	400	80
Female	100	20
Total	**500**	**100**
Educational level:		
No formal education	40	8
Primary	140	28
Secondary	130	26
Tertiary	60	12
Qumran	130	26
Total	**500**	**100**

Table 1…

Major Occupation:		
Farming	240	48
Civil servant	150	30
Business	70	14
Student	50	10
Total	**500**	**100**
Farm size: (ha)		
Less than 2	60	12
2 – 4	280	56
5 and above	160	32
Total	**500**	**100**
Farming Experience: (years)		
Less than 10	100	20
10 – 15	130	26
16 – 20	190	38
21 and above	80	16
Total	**500**	**100**
Annual Farm Income: (N)		
Less than 150,000	70	14
151,000 – 300,000	150	30
301,000 – 600,000	240	48
601,000 and above	40	8
Total	**500**	**100**

The result of the analysis in table 1 also indicates that 28% of the respondents had secondary education, while 8% did not attain any form of formal education. The result reveals that most of the respondents had undergone one form of education or the other in the study area. The level of education attained by farmers to a large extend determine the farmers level of adoption of new innovation without difficulties and resources use efficiency which in turn increase their output and subsequently the profit obtained by the farmer (Amaza and Olayemi, 2002).

The result of the study also indicates that 10% of the respondents were students, while 48% indicated their major occupation as farming. The result shows that most of the respondents are farmers engaged in barley production in the study area. The finding also reveals that 12% of the respondents cultivated less than two (2) hectares of land, while most 56% cultivated

between 2-4 hectares of land in the study area. From result of the finding, it can be concluded that most of the respondents are small scale barley farmers in the study.

The finding also indicates that 48% of the respondents earned N301,000- N600,000 annual farm income, while 8% earned N601,000 and above in the study area. Annual farm income of a farmer determine the farmers ability to purchase farm inputs such as: fertilizer, hired labour and improved technology, which may bring about increase in productivity and subsequently lead to higher income, thus the higher the annual income of a farmer, the greater the scale of agricultural production, he can undertake and the higher the profit in farming (Abubakar, 2004). The finding reveals that 38% of the respondents had between 16 – 20 years, while 18% had 21 years and above farming experience in the study area. This implies that most of the farmers have reasonable farming experience in the study area. The higher the number of years spent in farming by a farmer, the more he becomes aware of new production technique (Tijani *et. al.,* 2010).

Resource Use Efficiency in Barley production

Resource use efficiency of farmers was estimated using the double-log functional farm's coefficients (elaticities) of the various farm inputs used in barley production in the study area. The findings are presented in Table 2.

Table 2: Resource Use Efficiency in Barley Production

Variables		MVP	MFC	MVP/MFC	Elasticity production
Seed	(X1)	83.60	350	0.24	0.239
Farm size	(X2)	243.1	4500	0.10	0.054
Chemical	(X3)	652.6	2900	0.30	0.225
Hired labour	(X4)	337.3	1950	0.20	0.173
Family labour	(X5)	134.4	1600	0.10	0.084
Fertilizer	(X6)	0.990	5500	0.10	0.018
Mechanized	(X7)	605.5	3500	0.20	0.173
Total					**0.966**

The total sum of elasticities of the resources in Table 2 was 0.966, meaning 96.6 percent decrease in the quantity of the variable inputs will result in 0.966 percent decrease in barley output. This indicates decreasing return to scale which is the characteristics of stage one of the production function. This further suggests that the resources taken together are at present, been over-utilized and so farmers can have more return by decreasing the quantities of these

resources. Measure of technical efficiency of resource use such as marginal value product (MVP) and marginal value product and (MVP) marginal factors cost (MFC) were derived. The finding in Table 2 further reveals that the ratios of the MVP to the MFC were less than unity (1) for all inputs. This implies that inputs such as (seed, farm size, chemical, hired labour, family labour, fertilizer and mechanized labour) had been over- utilized.

CONCLUSION AND RECOMMENDATIONS

The study shows that most of the respondents were in their active and productive age group, majority were male, most had undergone one form of education or the other and are small scale farmers and have reasonable farming experience in the study area. The result shows that resources such as seed, farm size, chemical, hired labour, family labour, fertilizer and mechanized labour were over-utilized and farmers can have more return by decreasing the quantities of these resources Barley farmers were technically inefficient in the use of farm resources. The inefficiency of the farmers may be directly or indirectly linked to the high cost of seed, chemical, hired labour and mechanized labour. Improvement in the efficiency amongst the farmers is the responsibility of the individual farmers, government and research institutions. Making available all agricultural inputs required at the right time and at affordable price. Based on the findings of the study, barley farmers should form agricultural cooperative group that will enable them obtain credit from government and financial institutions; efficiency in barley production could be achieved through the decreased use of land, improved seed, fertilizer etc; non-governmental organization in collaboration with the farmers cooperative groups should provide improved agricultural technologies such as improved seeds, fertilizer at affordable rate to the farmers; and extension agents in the State should be provided with all the technical supports to reach out to the farmers and discharge their duties efficiently. Future studies should cover states and employ other efficiency estimation techniques, since the Ordinary Least Square (OLS) method has limitations.

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