

Economic Analysis of Rice Production in Central Agricultural Zone of Adamawa State, Nigeria

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Abstract: This paper analysed the economics of rice production in central agricultural zone of Adamawa state, Nigeria. Purposive and simple random sampling techniques were used to collect primary data from 130 rice farmers through field survey using well designed pre-tested schedule. Descriptive statistics, cost concept, stochastic frontier cost model, as well as Garrett's ranking technique were used to analysed the data. The results revealed that rice production was dominated by young literate men who had been in rice production for more than 20 years. Rice production was found to be profitable with net income over cost A_1 which is the direct cost involved in rice production as ₦146,049.11; while over cost C_3 which is the total cost of cultivation of rice was ₦100,083.62. The stochastic cost frontier model shows three parameters seed, family labour and agro-chemicals had positive and significant effect on the revenue of the rice farmers. Inadequate rainfalls, shortage of labour, clashes with pastoralist were the major constrains associated with rice production in the study area. The study suggest that government policies should be geared towards developing and establishing new fertilizer and agro-chemicals industries to ease the cost of farm inputs, as well as intensify farmer grazer conflict resolution programmes.

Key Words: Clashes with pastoralist Cost concept Nigeria Rice production

INTRODUCTION

Background of the Study

Nigeria is endowed with human and natural resources with verse fertile agricultural land suitable for cultivation of different crops. It has a total land area of 923,768 sq km comprising of 910,768 sq km land area and 13,000 sq km of water ranking 13th in the world (Nigeria Economy Starts, 2012). According to Trading economics, (2018) Gross Domestic Product (GDP) from agriculture in Nigeria averaged ₦3,771,185.70 million from 2010 until 2017, reaching an all-time high of ₦5,189,365.99 million in the third quarter of 2017 and a record low of ₦2,594,759.86 million in the first quarter of 2010. This placed Nigeria at 6th top agricultural countries by GDP

contribution in the world after China, India, United States, Indonesia and Brazil in 2017.

In Nigeria there are different methods of cultivating rice ranging from rain fed upland rice predominantly in the southern part of country but can also be found in north, the rain fed lowland rice found mainly along the flooded river valleys which accounts for more than half of the total rice land area in Nigeria, the irrigated rice that account for 16% of total rice land area in Nigeria others include deep-water/floating mangrove found in Sokoto Rima valleys and Kebbi where flooding achieves a depth of 60-100cm and mangrove swamp rice found where the ocean's tidal action causes inundation at high tide and drainage at low tide (Sanusi, 2014).

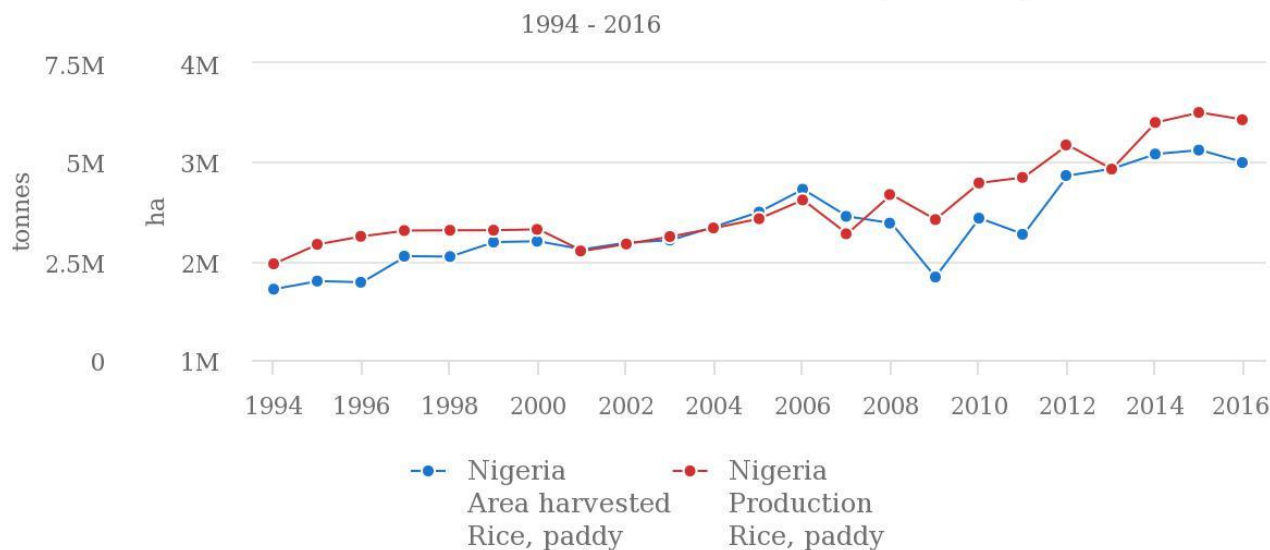
Rice is a seed cultivated in high water lands. It is the 2nd most produced cereal in the world after maize. It has enough calories to full the human energy. It can be grown on any place e.g. hills, swampy, plane areas. Largest rice producing countries need more labour to cultivate the seeds. It is an important cereal crop in Nigeria grown in both wet and dry season. There had been large variations in the production of rice in Nigeria from 1994-2016 (Fig. 1). It was only 2.4 million tonnes in 1994-5 which rose to 3.1 million tonnes in 1996 and remains steady till 2006 when it rose to 4 million tonnes. Rice production rose to 6.2 million tonnes in 2015 recording the highest level of production in the country in 3.1 million hectares

of land. However, there was a decline in production and area to 6.0 million tonnes and 2.9 million hectares respectively in 2016 cropping season (FAOSTAT, 2018).

This study, which was carried out in central agricultural zone of Adamawa state, Nigeria seeks to analyse the economics of rice production under the following objectives: to assess the socio-economic status of rice farmers, examine the cost and return, analyse the allocative efficiency and identify the constrains in rice production. Understanding and addressing these objectives will be a good step towards improving the standard of living of the people and attaining the target of rice self-sufficient in Nigeria.

Figure 1

Production/Yield quantities of Rice, paddy in Nigeria



Source: FAOSTAT (Mar 21, 2018)

METHODOLOGY

Study Area

Adamawa State north-eastern part of Nigeria is divided in to four agricultural zones based on soil; climate and vegetation .The central zone is noted for its numerous low land areas which are prone to

flooding during the wet season. Coupled with a moderate mean annual rainfall of about 900m, this zone is ideal for the production of crops like rice and maize. Apart from the large swampy areas (fadamas) found in parts of Yola, Fufore and Song local government areas of this zone, which support rice production during wet seasons, irrigated rice production is also practiced where

such fadamas are located near large irrigation water (Sajo and Kadams, 1999).

Sampling Procedure

Four out of Five local government areas (LGAs) in Adamawa central agricultural zone (Song, Fufore, Yola- North and South) were purposely selected based on their level of rice production (Table 1). Eight districts (Suktu, Mboi, Ribadu,

Gurin, Jimeta, Ngolomba, Yola and Namtari) two from each of the selected LGAs were purposely selected based on their level of rice production. Sixteen villages (Jimbo, Kupta, Gudu, Hada, Dulo, Dasin, Chikito, Pukka, Ngerio, Nboromji, Ngolomba, Jambutu, Ngurore, Ngoduwo, Bole and Rugange) two villages from each of the selected districts were also purposely selected based on their level of rice production. Thereafter, 130 respondents were randomly selected and used for the study.

TABLE 1

Distribution of Sampled Farmers

Local Government Areas	Name of Districts	Villages	No. of Respondents	
Song	1. Suktu	1. Jimbo	10	
		2. kupta	7	
	2. Gudu Mboi	3. Gudu	8	
		4. Hada	8	
Fufore	1. Ribadu	1. Dasin	10	
		2. Dulo	7	
	2. Gurin	3. Chikito	9	
		4. Pukka	6	
Yola- North	1. Jemita	1. Ngerio	10	
		2. Nboromji	8	
	2. Ngolomba	3. Ngolomba	8	
		4. Jambutu	7	
Yola-South	1. Yola	1. Bole	6	
		2. Rugange	10	
	2. Namtari	3. Ngurore	7	
		4. Ngoduwo	9	
Total	4	8	16	130

Sources and Period of Data Collection

The primary data for the present study were collected in a field survey through direct interview with rice farmers in Adamawa central

agricultural zone in November 2017. A total of 130 rice farmers were interviewed using pretested schedule in the study area. Secondary data were collected from relevant published research articles and text books.

Analytical Tool

Descriptive and inferential statistics were used to analysed the data.

The cost concept developed by the Commission on Agricultural Cost and Price (CACP) was adopted for the estimation of cost of cultivation of rice in the study area. The different costs were calculated as:

Cost A₁ = All actual expenses in cash and kind incurred in production by owner.

These include: cost of seed, cost incurred on manures and fertilizers, plant protection chemicals, land revenue, wages of hired human labour, hired labour charges of implements and machinery, charges for bullock labour, depreciation on fixed assets, excluding family labour.

Cost A₂ = Cost A₁ + rent paid for leased-in land.

Cost A₂+ FL = Cost A₂ + imputed value of family labour.

Cost B₁ = Cost A₁ + interest on value of owned fixed capital assets (excluding land).

Cost B₂ = Cost B₁ + rental value of owned land (net of land revenue) and rent paid for leased-in land.

Cost C₁ = Cost B₁ + imputed value of family labour.

Cost C₂ = Cost B₂ + imputed value of family labour.

Cost C₃ = Cost C₂ + 10 per cent of cost C₂ on account of managerial functions performed by the farmers. (Narayanamoorthy, 2013)

Allocative efficiency analysis

Allocative Efficiency (AE) refers to the ability to produce at a given level of output using the cost-minimizing input ratios. It can be measured through cost efficiency, revenue

Where:

efficiency and profit efficiency, which is a combination of the two (Wu, 1979). Cost efficiency is the ratio of respondents minimum possible production cost to actual production cost. Revenue efficiency is the ratio of the maximum possible income a respondent can receive to the actual income a respondent received. Profit efficiency is a combination of cost efficiency and revenue efficiency (Sihlongonyane, *et al.* 2014). A producer is allocative efficient if production occurs in a sub set of the economic boundary of the production possibilities set that satisfies the producer’s behavioral objective. The Allocative Efficiency (AE) in the use of variable inputs is given as the ratio of,

$$AE_{ij} = MGR_j / OGR_{ij}$$

Where: MGR_j is maximum possible gross revenue of the jth farms; and OGR_{ij} is gross revenue at the optimum level of the ith input with all input remaining at same level of the activity by jth farmer.

In order to determine optimal use of a resource, keeping the other resource constant, Marginal Value of Product (MVP) and opportunity cost (factor) of that resources was compared. It was estimated from the parameter of Cob Douglas production function. The criterion for determining optimality of resource use:

MVP/MPC > 1 underutilization of resource

MVP/MPC = 1 optimal use of resource

MVP/MPC < 1 excess use of resources

The corresponding cost frontier of Cobb-Douglas functional form which is the basis of estimating the allocative efficiencies of rice farmers in the study area is specify and defined as follows:

$$\ln C_{ij} = \beta_0 + \beta_1 \ln P_{1ij} + \beta_2 \ln P_{2ij} + \dots + \beta_6 \ln P_{6ij} + V_{ij} - U_{ij}$$

Subscript ij refers to the jth observation of ith farmers.

Where: C_{ij} is total cost of production (₦), \ln is logarithm to base e, P_1 is rental value of own land (₦), P_2 is cost of seed (₦), P_3 is cost of hired labour (₦), P_4 is cost of family labour (₦), P_5 is cost of agro-chemicals (₦), P_6 is cost of fertilizer (₦), V_i is the random variable which is assumed to be normally distributed $N(0, \delta^2 v)$ and independent of U_i . It assumed to account for random factors such as weather, risk and measurement error and $U_i =$ is the non- negative error term having zero mean, and constant variance i.e. $N(0, \delta^2 U)$ (Xu and Jeffrey, 1998).

Garret’s ranking technique was adopted to identify constraints in rice cultivation. The respondents were asked to rank ten set of constraints that were related to rice production. The order of merits that were given by the respondents was converted into ranks using the following formula given by Jagdish *et al.* (2008).

$$\text{Percentage Position} = \frac{100 (R_{ij} - 0.50)}{N_j}$$

Where,

R_{ij} = Rank given for the i^{th} constraints by the j^{th} farmer;

N_j = Number of constraints ranked by the j^{th} individual.

RESULTS AND DISCUSSION

Socio-economic status of the respondents

Socio-economic status of a farmer is an economic and sociological combined total measure of his work experience or family's economic and social position in relation to others, based on age, gender, household size, literacy level, farming experience, extension contacts etc. These characteristics as they relate to rice farmers in central agricultural zone of Adamawa state, Nigeria were presented in Table 2. The results revealed that rice production was dominated by young (88.46%), literate (65.38%), men (78.46%)

who had been in rice production for more than 20 years. This accord the report made by Matanmi *et al.* (2011) that rice production is dominated by young married men who are literate and had been in production for long in their study on perceived factors limiting rice production in Patigi local government area of Kwara state, Nigeria. This implies that rice farmers have the ability to accept and adopt new agricultural production systems and techniques, and so they have the capacity to undertake agricultural production activities with fewer constraints. The mean household size was found to be 8.00 which indicate that farmers will spend less on hired labour since the households had a high labour force to carry out agricultural production. Majority of them (80.77%) had no contacts with extension agents. The result shows that most of the farmers are likely to be technically less efficient in the use of improved methods and practices in rice production since lack of extension services hinders farmers from adopting new innovations.

Cost of rice production in central agricultural zone of Adamawa state, Nigeria

Table 3 revealed the cost of cultivating rice in central agricultural zone of Adamawa state, Nigeria. On the average cost C_3 (total cost) was found to be ₦121,166.38. The average variable cost was found to occupy 74.86 percent of cost C_3 with cost of family labour, fertilizer, agro-chemicals (14.44, 12.42 and 11.64 per cent) respectively of the total cost of cultivation. While the average fixed cost was found to occupy 16.05 percent of cost C_3 . The result agrees with Girei *et al.* (2016) who also reported an average total cost of ₦135,432 for two cycles per annum from dry season rice production with cost of labour accounted for the largest proportion of the total cost of the production.

TABLE 2

**Socio-economic
production**

characteristics of rice

Factors	Frequency	Percentage
Gender		
Male	102	78.46
Female	28	21.54
Total	130	100.00
Age (years)		
15- 24	65	50.00
25-34	50	38.46
35-44	10	7.69
> 45	05	3.85
Total	130	100.00
Mean	26.04	
Literacy level		
No formal Edu.	45	34.62
Formal education	85	65.38
Total	130	100.00
Experience (years)		
≤20	70	53.85
21-40	48	36.92
≥41	12	9.23
Total	130	100.00
Mean	21.58	
Household size		
1-10	102	78.46
11-20	25	19.23
≥21	03	2.31
Total	130	100.00
Mean	7.88	
Extension contacts		
Yes	25	19.23
No	105	80.77
Total	130	100.00

Operational Cost	Amount (₦)	% to total cost (C3)
Seed	10,115.57	8.35
Family Labour	17,500.00	14.44
Hired Labour	13,599.17	11.22
Machine Labour	4,150.12	3.43
Bullock	2,000.64	1.65
Fertilizer	15,050.33	12.42
Chemicals	14,100.12	11.64
Farm yard Manure	884.85	0.73
Storage	5261.68	4.34
Transportation	4,000.32	3.30
Repair of Farm House	759.55	0.63
Total working capital	87,422.35	72.15
Interest on working Capital	3,278.34	2.71
Sub Total	90,700.69	74.86
Fixed Cost		0.00
Depreciation	2,000.22	1.65
Rent paid for leased land	6,000.00	4.95
Rent value for own Land	10,500.00	8.67
Interest on fixed capital excluding Land	950.36	0.78
Sub total	19,450.58	16.05
10% Managerial Cost	11,015.13	9.09
Cost Of Cultivation		0.00
Cost A1	75,200.89	62.06
Cost A2	81,200.89	67.02
Cost A2+ FL	98,700.89	81.46
Cost B1	76,151.25	62.85
Cost B2	92,651.25	76.47
Cost C1	93,651.25	77.29
Cost C2	110,151.25	90.91
Cost C3	121,166.38	100.00

Cost of Cultivation of Rice in Central Agricultural Zone of Adamawa state

TABLE 4

Cost and Return in Rice Production	Particulars	Total cost
Cost and return in rice production in central agricultural zone of Adamawa state, Nigeria	Crop Yield	
	Grain/Main Product (Bags/Ha)	29
	By Product (kg/Ha)	15
	Market Price (₦)	
	Grain/Main Product	7,500
	By Product	250
	Gross Income (₦/Ha)	221,250
	Gross Margin (₦/Ha)	130,549.31
	Net Income Over	
	Cost A1	146,049.11
Cost A2	140,049.11	
Cost A2+ FL	122,549.11	
Cost B1	145,098.75	
Cost B2	128,598.75	
Cost C1	127,598.75	
Cost C2	111,098.75	
Cost C3	100,083.62	
	Input-Output Ratio Over	
	Cost A1	1: 2.94
	Cost A2	1: 2.72
	Cost A2+ FL	1: 2.24
	Cost B1	1: 2.91
	Cost B2	1: 2.39
	Cost C1	1: 2.36
	Cost C2	1: 2.01
	Cost C3	1: 1.83
	Cost of Production (₦/Ha)	
	Cost A1	2,593.13
	Cost A2	2,800.03
	Cost A2+ FL	3,403.48
	Cost B1	2,625.91
	Cost B2	3,194.87
	Cost C1	3,229.35
	Cost C2	3,798.32
	Cost C3	4,178.15

Per hectare crop yield for rice production was found to be 29.00 bags for main product and 15.00 kg for by-product (Table 4). The gross income and margin was found to be ₦221,250 and ₦130,549.31 respectively. The net income over cost A1 which is the direct cost involved in rice production was ₦146,049.11; while over cost C₃ which is the total cost of cultivation of rice was ₦100,083.62. The input-output ratio analysis was worked out on the basis of cost A₁ to C₃. Cost A₁ has the highest ratio of 1: 2.94 while cost C₃ has the lowest ratio of 1:1.83 in central

agricultural zone of Adamawa state, Nigeria. The study concord the finding of Usman

2018 that rice production is profitable in song local government with net income over

cost C_3 of ₦45,176.15 per hectare.

Allocative efficiency

Table 5 depicts the Maximum Likelihood Estimate (MLE) of the parameters of the stochastic cost frontier model used in estimating allocative efficiency of rice farmers in central agricultural zone of Adamawa state, Nigeria. . The result shows that three out of six parameters measured (seed, family labour and agro-chemicals) were positively significant towards the efficiency of farmers at five and ten percent level which implies that the revenue in rice production will increase by 0.079, 0.172 and 0.012 percent respectively on one percent increase in the study area. Samarpitha *et al.* (2016) also found human labour as the major determinant of rice productivity in Nalgonda district of Telangana state.

The inefficiency parameters included in the model specifically, those related to farmers’ socio-economic characteristics such as age, gender, family size, level of education, farming experience and extension contacts were also revealed in Table 5. The signs in the inefficiency model were explained in the opposite way such that a negative sign indicates decrease in allocative inefficiency while positive sign indicates increase. The estimated coefficient of age, education and extension contacts with -0.014, -0.015, and -0.399 respectively carried the expected negative sign and was statistically significant at ten percent level of significance in the study area. This implies that one unit increase in these variables will

decrease allocative inefficiency as well as increase the output of the rice production in central agricultural zone of Adamawa state, Nigeria. The coefficient of sigma squared and gamma in the study area were 4.846 and 0.765 and it was statistically significant at ten and one percent level of significance respectively. Thus, the diagnostic statistics confirm the relevance of the stochastic production function.

Table 5 further revealed the results of the allocative efficiency indices of rice farmers in central agricultural zone of Adamawa state, Nigeria. The mean allocative efficiency was found to be 0.89 indicated that an average farmer in the study area has the scope for increasing allocative efficiency by 11 per cent in the short-run under the existing technology. This would enable the average farmer equate the marginal value product (MVP) of the inputs to the total production. The superlative practice farmers operated at about 98 per cent efficiency; while the least practice farmers were found to operate at about 54 percent efficiency level in the study area. It is in line with the finding of Samarpitha *et al.* (2016) who also reported high mean allocative efficiency of 88.36 per cent in their study on technical, economic and allocative efficiencies of rice farms in Nalgonda district of Telangana state.

TABLE 5

Maximum Likelihood Estimate of Stochastic Frontier Cost function for Rice Farmers in Central Agricultural zone of Adamawa State, Nigeria

Variables Production Factors	Parameter	Coefficient	t-ratio
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Constant	β_0	2.5966	3.8604*
Rental value of own land (P ₁)	β_1	0.0909	0.5162 NS
Cost of Seed(P ₂)	β_2	0.0787	2.0109**
Cost of Hired labour (P ₃)	β_3	0.0073	1.2843 NS
Cost of Family labour (P ₄)	β_4	0.1721	2.4576**
Cost of Chemicals (P ₅)	β_5	0.0120	1.6668***
Cost of Fertilizer (P ₆)	β_6	0.0233	0.1555 NS
Inefficiency Model			
Constant	δ_0	-0.7152	-1.3440 NS
Age (Z ₁)	δ_2	-0.0146	-1.9488***
Sex (Z ₂)	δ_1	-0.0432	-0.2951 NS
Farming Experience (Z ₃)	δ_3	0.065	0.1623 NS
Education (Z ₄)	δ_4	-0.0151	-1.6529***
Family Size (Z ₅)	δ_5	0.1292	0.9220 NS
Extension Contacts (Z ₆)	δ_6	-0.3990	-1.8252***
Variance Parameters			
Sigma-Square (δ)		4.8461	1.8252***
Gamma (γ)		0.7648	4.6893*
Efficiency Rating			
Minimum efficiency	0.54		
Maximum efficiency	0.98		
Mean efficiency	0.89		

* Significant at 1% level of significance;

** Significant at 5% level of significance.

*** Significant at 10% level of significance

Constrains in Rice Production

To identify and prioritize ten constrains in rice production in the study area. The percentage position of each rank was converted into scores using Garret's table. For each constraint, scores of individual respondents was added together and then divided by total number of respondents for whom scores was added. Thus, mean score for each constraint was ranked by arranging them in the descending order (Table 6).

Table 7 depicts constrains in rice production in central agricultural zone of Adamawa state. Going by the average total mean for the ten constraints sampled, the result shows

that inadequate rainfalls, shortage of labour, clashes with pastoralist, striga infestation and inadequate farm credit were identified as the major constrains associated with rice production in the study area. However, these constrains were concisely expressed by the respondents as follows:

Rice requires ample water for its production and rainfalls; to a major extent provide this water through the soil for the development and growth of plants. Inadequate rainfalls poses a serious problem to rice production in central zone of Adamawa state and was ranked 1st by the respondents.

TABLE 6

Rank	Constraints	Percentage	Position	Garret table (scores)
1	Shortage of labour	100(1-0.5)/10	5	82
2	Clashes with pastoralists	100(2-0.5)/10	15	71
3	Inadequate farm credit	100(3-0.5)/10	25	64
4	Striga infestation	100(4-0.5)/10	35	58
5	Inadequate rainfall	100(5-0.5)/10	45	53
6	Shortage/high cost of inputs	100(6-0.5)/10	55	48
7	Pests and diseases	100(7-0.5)/10	65	43
8	Birds infestation	100(8-0.5)/10	75	37
9	Inadequate research and extension support	100(9-0.5)/10	85	30
10	Land tenure	100(10-0.5)/10	95	19

Percentage Positions and their corresponding Garrett’s Table values

This is in line with what Adedeji *et al.* (2017) reported in their study on the effect of climate change on rice production in Adamawa State, Nigeria, that rainfalls and temperature were the major climatic factors that affect rice production such that 1% increase in rainfall leads to 22.2% increase in rice production.

Labour has special contributions in the production of rice in other words it is the fundamental and active factor of production. Farmers complain bitterly on high cost and inadequate supply of physical, mental, productive, skilled and unskilled labour in the study area. It was ranked 2nd by the respondents. This agreed with what Kwinarajit and Gary 2004 reported that shortage of labour is a major factor affecting Thai rice in their study on economic factors affecting rice production in Thailand. Clashes between rice farmers and pastoralists over grazing fields are common in northern Nigeria and are increasing throughout the country as pastureland shrinks. It usually

occurs when herdsman led their cattle into rice fields and grazed on the crops. This often results in a serious conflict where scores of houses were completely burnt and crops on several farms were destroyed. Although the Nomads complain that wherever they turn and find out that the land reserved for their cattle to feast, were taken over by farmers. It becomes difficult for their herd to move and graze without veering into crop fields. It was ranked 3rd by the respondents in the study area.

Striga also known as witch weed parasitizes is capable of significantly reducing yields, in some cases wiping out the entire crop. Each plant is capable of producing between 90,000 and 500,000 seeds, which may remain viable in the soil for over 10 years. Management of witch weed is difficult because majority of its life cycle takes place below ground; but if populations are low, hand weeding before seeds are produced is an option (Wikipedia, 2018). It was ranked 4th by the respondents in the study area. The

findings accord the report by Evans *et al.* (2011) that notable advances in Striga weed control technology have been made, yet the weed continues to be a major cause of low agricultural production in their study on Evaluation of ecologies and severity of Striga weeds on rice in sub-Saharan Africa. The availability of credit can affect fixed production costs and farmers will use fewer seeds and fertilizer if they are credit constrained (Brambilla and Porto, 2005). Credit may influence farmers' participation

. Conclusion and Recommendations

This paper analyses the economics of rice production in central agricultural zone of Adamawa state, Nigeria. The results indicated that rice production is profitable with net income over cost A_1 which is the direct cost involved in rice production of ₦146,049.11; while over cost C_3 which is the total cost of cultivation of rice was ₦100,083.62. The stochastic cost frontier model shows a mean allocative efficiency of 0.89 which indicated that an average farmer in the study area has the scope for increasing

in marketing systems and increase their ability to generate higher incomes through its effect on production, output and marketing costs. Inadequate farm credit was ranked 5th by the respondents. Ibrahim (2014) also reported that poor provision of credit facilities as the major adoption decision on rice production technologies by farming households under Borno state Agricultural Development Programme, Nigeria.

allocative efficiency by 11 per cent in the short-run under the existing technology. Inadequate rainfall, shortage of labour, clashes with pastoralist was the major constraints associated with rice production in the study area. The study suggest that government policies should be geared towards developing and establishing new fertilizer and agro-chemicals industries to ease the cost of inputs as well as intensify farmer grazer conflict resolution programmes.

TABLE 7

S/ No	Constraints	Ranks by respondents for each constrains										Total no. of respondents	Total score	Total mean	Overall rank
		1	2	3	4	5	6	7	8	9	10				
1	Shortage of labour	29	30	28	20	10	10	3	0	0	0	130	8599	66.15	2
2	Clashes with pastoralists	22	19	21	20	16	11	9	10	0	2	130	7828	60.22	3
3	Inadequate farm credit	24	8	25	10	8	14	3	17	1	20	130	6980	53.69	5
4	Striga infestation	10	30	20	19	10	12	12	6	4	7	130	7429	57.15	4
5	Inadequate rainfall	40	25	30	10	8	7	8	1	0	1	130	8715	67.04	1
6	Shortage/high cost of inputs	2	12	6	19	45	28	7	11	0	0	130	6939	53.38	6
7	Pests and diseases	3	5	0	10	6	16	28	19	33	10	130	5354	41.18	7
8	Birds infestation	0	0	0	4	8	3	10	11	44	50	130	3907	30.05	10
9	Inadequate extension support	0	1	0	2	10	21	20	16	30	30	130	4647	35.75	9
10	Land tenure	0	0	0	16	9	8	30	39	18	10	130	5252	40.4	8

Ranking Constraints associated to rice production in central Agricultural zone of Adamawa State

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