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COWPEA FARMING IN MASHEGU LOCAL GOVERNMENT AREA OF NIGER STATE: IMPLICATIONS FOR SUSTAINABLE PRODUCTION AND INCLUSIVE GROWTH IN NIGERIA

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ABSTRACT

The study examined the economics and sustainability of cowpea farming among small scale farmers in Mashegu Local Government Area of Niger State, Nigeria. Descriptive statistics, multiple regression model, resource use efficiency ratio and returns to scale index, as well as, costs and returns measures were employed for data analysis. The descriptive and content analysis revealed that cowpea production in the study area was male gender bias given that 93% of the respondents were men. About 25.4% were not educated, while 76.1 % had above 5 years farming experience. Results from the regression analysis model indicated that 4 variables, namely; farm size, labour, fertilizer and household size were positive significant determinants of cowpea output at 1% probability level each. The costs and returns analysis puts the average gross margin at ₦73,991 per hectare, implying that cowpea production was profitable and sustainable. The estimated elasticity of 1.1031 connotes increasing returns to scale. This indicates that a unit increase in the factors used in the production will lead to a corresponding increment of cowpea output by 1.1% .The study concluded that cowpea production in the study area was profitable and sustainable but resources were not efficiently utilized. In-spite of this, cultivation of cowpea in the study area has the potentials for enhancing sustainable agricultural development and propelling inclusive growth in the country, given its ability to remain economically viable. Against this background, it was recommended that Niger State Government, through the Extension Component of the State Agricultural Mechanization and Development Authority (NAMDA) promote efficient use of inputs amongst cowpea farmers in the study area with the view to ensuring profitable, sustainable cowpea production and un-locking cowpea inclusive growth potentials

Keywords: Cowpea Farming, Efficiency, Sustainable Agricultural Development and Inclusive Growth.

INTRODUCTION

Cowpea is an important food legume grown in the semi-arid tropics, covering Africa, Asia, Southern Europe and Central South America (Davis, 2013). It is one of the ancient crops known to man and is cultivated primarily for grain, but also as vegetable (leafy green, green pods, shelled dried peas, and fresh shelled green peas), a fodder and cover crop. Moreover, cowpea forage is significant to animal feeds mainly during the dry season when the demand for the feeds is at its peak. Its ability to replenish soil nitrogen gives it a key position in the modern crop farming system in rotation with other crops, with the view for long term sustainable agriculture development prospect. Tarawali *et al*.**,** (2002) noted that cowpea has a wide role in contributing to food security, income generation and sustainable environment for millions of small scale farmers who cultivate it in the region. Cowpea also contains bioactive antioxidants such as vitamin c, carotenoids and phenolic compounds. The compounds represent a crucial group of bio-active elements in foods which prevents development of diseases such as atherosclerosis and cancer (Omae, 2011). Due to the increase in the demand for the crop, arising from the growing population in the country, Nigeria remains the largest producer and consumer of cowpea both in West Africa and in the World (FAO, 2010 and IITA, 2011). In the country, the greatest production of cowpea comes from the northern region. The north produces about 1.7 million tonnes from 40 million hectares. This represents over 60% of the total production (FAO, 2010). Sole cropping system with the use of improved technologies can yield 1,500 - 2,000 kg/ha of cowpea. However, 200 - 250 kg/ha yield is obtained by small scale farmers who are the domestic producers in the country (Wakili, 2013).

In Niger State, like in other parts of the country, cowpea is currently produced by small scale farmers using rudimentary implements. Coulibaly and Lowenberg-DeBoer (2002) affirmed that despite the importance of the crop in food security and poverty reduction, increased production, storage and marketing face constraints that needed redress. In the same vein, Obayelu (2013) noted that the average land holdings for most cowpea farmers are less than two hectares while family labour remains the essential input. Land is based on communal ownership, inherited or rented with ease of outright purchase rare to come by. Capital is also a major limitation, with a few farmers having access to rural credit, coupled with weak sustainable production practices. This development raises pertinent questions as to the profitability and sustainability of cowpea production in Mashegu Local Government Area of Niger State. The broad objective of the study was to examine the economics of cowpea production in Mashegu Local Government Area of Niger State. The specific objectives were to: (i) describe the socio economic characteristics of cowpea farmers in the study area; (ii) determine the costs and returns on cowpea production in the study area; (iii) ascertain the determinants of cowpea production among farmers in the study area; (iv) examine the efficiencies of resources used by cowpea farmers in the study area; (v) examine the problems associated with cowpea production in the study area; and (vi) discuss the implications of the results for sustainable cowpea production in the study area.

This study is justified given that most research on cowpea farming have focused on aspects of productivity and profitability with less emphasis on sustainability issues and its implications for sustainable agricultural development.

The hypotheses tested were that:

Ho: Cowpea production in the study area was profitable and thus, sustainable.

Ha: Cowpea production in the study area was not profitable and thus, un-sustainable.

LITERATURE REVIEW

According IITA (2012), cowpea dates back to the ancient West African cereal farming where its cultivation is associated with that of sorghum and pearl millet (Amakobe, 2012). Coulibaly and Lowenberg-DeBoer (2002) further noted that the demand for this legume in West Africa has been on the rise due to high population growth, poverty and demand for low cost food. The Consultative Group on International Agricultural Research (2010) also revealed that about 14.5 million hectares of land worldwide are cultivated annually with cowpea and in 2010, global production of cowpea stood at 5.5 million metric tons.

Cowpea is a drought tolerant and warm weather crop. It is well adapted to drier regions of the tropics, where other food legumes do not strive well. It grows well in poor soils with, more than 85% sand and with less than 0.2% organic matter and low levels of phosphorus (Manjula, 2011). Musa (2010) reported that with the use of improved technologies, yield of 1,500-2,000 kg/ha can be obtained on sole cropping system. Efficiency and productivity potentials are also high if the farmers use more of improved seeds, family labour, agrochemicals, less of hired labour and land (Jirgi, 2010).

Cowpea Production and Productivity in Nigeria

Coulibaly and Lowenberg-DeBoer (2002) reported that Nigeria is the largest producer of cowpea in Africa and the World; but that substantial amount of this staple come into the country from Niger, Chad and Cameroon. In Nigeria, cowpea adapts well to wet conditions, as well as by supplementary irrigation or residual moisture along river or lake flood plains during the dry season, in as much as the range of minimum and maximum temperatures is between 28° and 30°C (night and day) during the growing season. Cowpea performs well in agro ecological zones where rainfall range is between 500 mm and 1,200 mm/year. However, with the development of extra-early and early maturing cowpea varieties, the crop can thrive in the Sahel where rainfall is less than 500 mm per year. It is tolerant of drought and well adapted to sandy and poor soils. However, best yields are obtained in well-drained sandy loam to clay loam soils with the pH range of between 6 and 7. Cowpea yields in Niger state and Nigeria have been on the increase between 1999 and 2010, rising from 490 kg/ha to 651Kg/Ha in the case of the former and 474Kg/Ha and 687Kg/Ha in the case of the latter, with average growth of 3% and 4% respectively (See Figure 1 and Table 1). In 2010, Nigeria produced 2.2 million metric tons of cowpea, making her the largest producer and consumer of the crop with estimated yield put at 687 Kg/Ha (FMARD, 2011) compared to the mean of 450 kilogram per hectare obtained globally.

Table 1: Cowpea Yield Data for Niger State and Nigeria (Kg/Ha) Showing Growth Potentials

Year	NIGER STATE	% GROWTH	NIGERIA	% GROWTH
1999	490	0	474	0
2000	458	-6	478	1
2001	500	9	502	5
2002	533	7	502	0
2003	569	7	503	0
2004	527	-7	519	3
2005	509	-3	551	6
2006	475	-7	560	2
2007	553	17	556	-1
2008	537	-3	503	-10
2009	619	15	499	-1
2010	651	5	687	38
MEAN	**535**	**3**	**528**	**4**

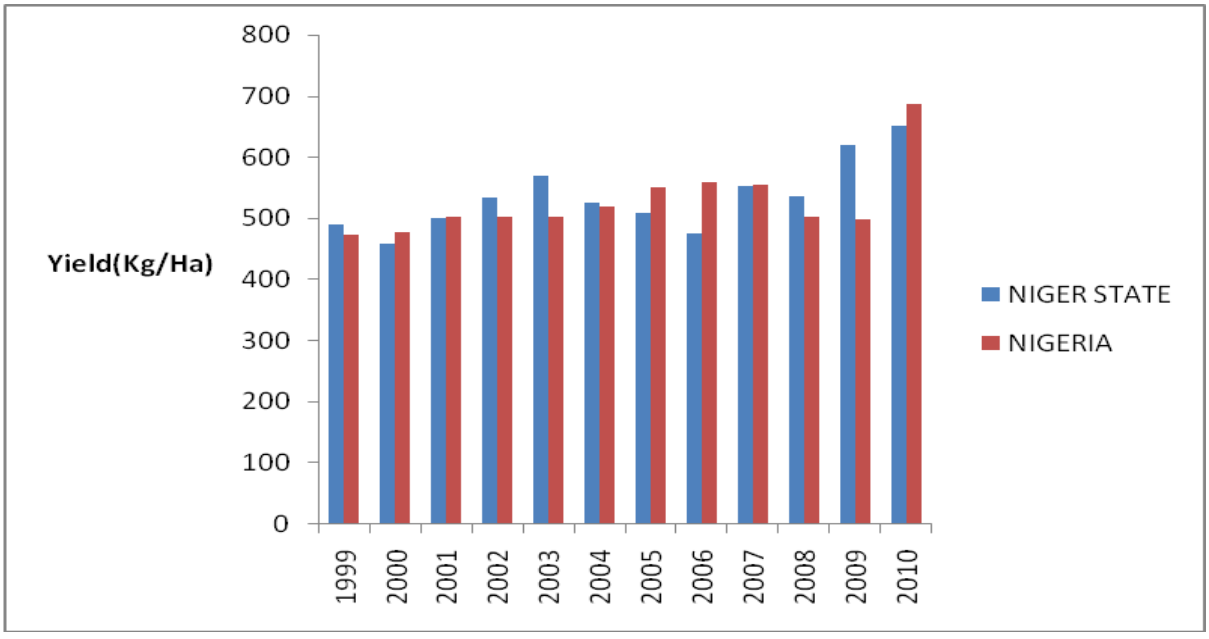

Figure 1: Yield data for Niger State and Nigeria (1999 - 2010)

Generated from data obtained from FMARD (2011)

Resource Use and Efficiency

Numerous researchers have revealed how sustainable agriculture can be achieved in Nigeria and the world at large. These efforts included consideration for future adequacies, while tackling issues bordering on resource use efficiency, profitability of farmers production and impacts on the environment. However, for agriculture to be sustainable to meet today's world food needs, as well as those in the future, it must do a better job of communicating with its clientele world food consumers (Mary, 2010). Resource allocation and productivity are significant aspects of increased food production which works in line with the management of the farmers who uses these resources in production. Efficiency in the use of available resources is a major pivot for a profitable and sustainable farm enterprise. According to Bala (2010), inefficiency in the use of resources, wrong choice of enterprise combination and cropping systems constitute the major constraints to increased food production in Nigeria. Furthermore, Omonona (2010) observed that measuring efficiency is significant because this it is the first step in a process that might lead to substantial resource savings. Resource savings have important implications for sustainable production, policy formulations and enterprise management.

Economic Importance of Cowpea

IITA (2009) noted that there is a big market for the sale of cowpea grains and fodders in West Africa and that, in Nigeria, farmers who cut and store cowpea fodder for sale at the peak of the dry season have been found to increase their annual income by 25%. Economically, cowpea has been proven to promote trade between production and non-production areas. It has also served as income generating avenues for other value chain actors within the cowpea chain. The returns from cowpea marketing like any other business firm ensure sustainability of the system through enhanced revenue generation to both marketers and producers. However, the challenge that marketers face is to satisfy consumers' wants at a reasonable profit level and in a socially acceptable manner (Girei, 2013).

In most parts of Nigeria, this protein-rich crop is processed into beans cake, moi-moi and beans soup; while in the northern parts, particularly in Niger State, cowpea has been a key source of income for farmers and processors. Cowpea farmers, who adopted improved cowpea varieties and management practices, reported an average of 55 per cent rise in their incomes (IITA, 2011). Cowpea contains 20% - 25% of protein and 64% carbohydrate and has potential for poverty alleviation and malnutrition amongst the poor (Alice, 2010). Nigeria, the largest economy in Africa, supports complementary food production to meet the nutritional needs of its teeming population through home grown initiatives and most of the on-going food security related projects and programmes, such as the Food and Agriculture Organisation assisted National Programme for Food Security operational in 327 sites across the country and the closed International Fund for Agricultural Development supported Community Based Agricultural and Rural Development Programme implemented in the north-western parts of Nigeria.

Profitability of Cowpea of Production

Profitability has been generally recognized as the main motive of any business enterprises. Without making profit, sustainability is likely to be in doubt. Thus, reviewing profit trends and sustaining future profitability is crucial (Don, 2013). Major motivation for productivity is profitability. The efficient allocation of resources at the farm level has implications for

sustainable production of crop and national development, given the need to achieve inclusive growth in the country. It is however worthy of mention that profit maximization may not be the primary goal of the small-holder in the long run, given the need to meet other goals (Pelagia, 2011). It is therefore believed that analysis of production, productivity, profitability, resource use efficiency and sustainable production of cowpea allows for policy recommendations for better efficiency and productivity. Profitability is measured with an income statement, involving a listing of income and expenses during a production season (usually a year) for the entire business (Don, 2013).

Cowpea and Sustainable Agricultural Development

In simplest terms, sustainable agriculture is the production of food, fiber, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. This form of agriculture enables us to produce healthful food without compromising future generations' ability to do the same. Bruntland (1987) refers to sustainable development as development that meets the needs of the present without compromising the ability of further generations to meet their own needs. According to this source, few people fully understand the term or how to apply it to everyday life. Bationo, Ntare, Tarawali, and Tabo (2002) observed that despite the need to apply inorganic fertilizers for yield improvement, the use of mineral fertilizer in West Africa is limited by lack of capital, inefficient distribution systems and poor enabling policies and other socio-economic factors. Cereal-legume mixture therefore comes handy as a cheaper means of improving soil fertility and productivity. Many researchers have also shown that incorporating cowpea into the cropping system is crucial for sustainable crop production in sub-Sahara Africa, since it promotes resource management in cereal-based cropping systems. To promote sustainable agricultural development, the United Nations Rio plus 20 conference on sustainable development, amongst other time-bound commitments agreed on the need to prepare and implement comprehensive policies and programmes leading to management and utilization of land resources and soil fertility for sustainable agricultural development (UNCSD, 2012). Cowpea production, particularly in rotation, is one of the sustainable means of achieving soil fertility. However, smallholder farmers have been unable to intensify agriculture through use of methods that is environmentally sustainable, as well as ecologically productive. The vegetation of the country, particularly, the northern parts have not really helped matters, given the hot climate, with seasonal rainfall and a unique dry season. Increasing population which has pushed up food demand has also being an issue (Free Wikipedia, 2011). On it part, OECD (2008) revealed that the steady increase in agricultural productivity was associated with technology and structural changes. It argued that while technology continue to contribute significantly to productivity increases, policies are needed to minimize agriculture's potentially harmful impact on biodiversity, resource use and ecosystem. However, it has often been argued that African farmers are unsuccessful at intensifying agriculture through the utilization of a method that is environmentally sustainable, as well as economically productive. For instance, the vegetation of northern Nigeria is predominantly marginal and characterized by a relatively hot climate with seasonal rainfall and a marked dry season. However, the pressures of increasing population has been a cause of increasing food demands, the expansion of cultivated areas, reduced fallow intervals with a shortage of inputs necessary to compensate leads to soil fertility reduction. In-spite of this, cultivation of cowpea in the study area has the potentials for enhancing sustainable agricultural development given its ability to remain economically viable, providing farmers, farm-labourers, and others employed in the cowpea value chain with means of livelihood.

METHODOLOGY

Study Area

The study was conducted in Mashegu Local Government Area (LGA). The study area is one of the twenty five (25) Local Governments Areas of Niger State, Nigeria. The LGA was carved out of Wushishi LGA in 1996 and it is located in the eastern part of Niger State in northern Nigeria (Figure 1). Mashegu is bounded by the Niger River by the west and Kaduna River in the northeast. It lies between latitude 9° 57N and longitude 5° 13E with Mashegu town being the headquarters of the LGA, covering ten wards. It covers a land area of about 9,182 sq km. The LGA experiences rainfall of between 100mm and 1200mm from July to October. Between February and May, just before the rain sets in, the cold dry harmattan wind and the arid season becomes hotter. The mean daily temperature is high throughout the year and it is about 32^0C. The vegetation is mainly short grass and shrubs with scattered trees. The LGA has an estimated population of 215,022 (census, 2006), with mixed tribes of Hausa, Fulani, Dakarkari, Nupe and Gwari. The main occupation of the people is farming while the major crops grown are yam, rice, cowpea, sorghum, maize, groundnut, tomato and sweet potatoes, amongst others.

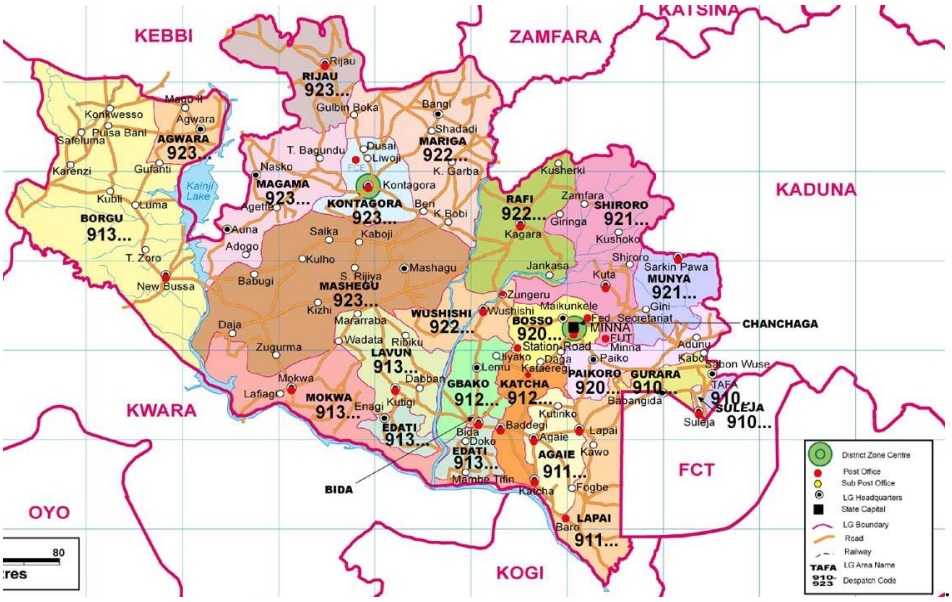

Figure 2: Map of Niger State of Nigeria showing the Study Area (923)
Source: Open internet window

Sampling Techniques

The multi-stage sampling technique was employed for this study. The first stage involved the purposive selection of Mashegu from the 25 LGAs in the State, given the predominance of cowpea farmers in the area. The second stage entailed the selection of 10 wards out of the 15 available in the LGA, using the simple random sampling, while the third stage involved the selection of 15 farmers from each ward based on the Household Listing Frame of the LGA available with the Niger State

Agricultural and Mechanization Development Authority (NAMDA) and the sample size calculator. A total of 150 farmers were covered under this study with 8 respondents discountenanced, leaving a total of 142 sampled households.

Data Collection Method

Data for the study were obtained from both primary and secondary sources. Primary data were collected with the aid of structured questionnaires administered to the respondents. Secondary data were obtained from Federal Ministry of Agriculture and Rural Development, National Bureau of Statistics, NAMDA, Journals and Internet sources. Data collected covered socio-economic variables, production statistics, among others.

Analytical Techniques

Description of Socio-economic Characteristics

Descriptive statistics such as mean, frequency distribution, percentages, ratios were used to analyze objectives (i), (v) and (vi) of this study.

Costs and Returns Analysis of Cowpea Production

The estimation of cowpea production costs and returns (objective ii) was done using the gross margin analysis**.** Gross margin is difference between the gross farm income (GFI) and the total variable cost (TVC). It is useful as planning tools in situations where fixed capital is a negligible potion of the planning enterprise as it was in the case of cowpea production in Mashegu LGA. The formula is specified below:

GM = GFI - TVC
Where:
GM= Gross Margin
GFI = Gross Farm Income
TVC = Total Variable Cost

Determinants of Cowpea Production and Efficiency of Resource Use

The production function model was used to ascertain the determinants of cowpea production (objective iii) and efficiencies of resources used in the study area (objective iv). The model was specified as follows:

$Y= b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9 + e$
Where Y= Cowpea Output (Kg)
X_1= Quantity of Seeds Used (Kg)
X_2 = Farm Size (Ha)
X_3 = Labour Used (Man-days)
X_4 = Quantity of Fertilizers Used (Kg)

X_5 = Agro Chemicals Used (Litres)

X_6 = Respondents' Household Size (Number)

X_7 = Age of Farmer (Years)

X_8= Farmers' Educational Level (Years)

X_9= Farming Experience (Years)

U = Error Term

The significance of the variables will infer if they are determinants of cowpea production in Mashegu LGA. Four functional forms were tried and the equation with the best goodness of fit was selected. The selection was based on the significance of the entire model as depicted by the F value, coefficient of multiple Determination (R^2), number of significant variables and conformity of variables with a priori expectations.

Where: $b_1 – b_9$ are the coefficients of the corresponding variables and these variables are as defined earlier, b_0 is the constant of the regression model and e is the error term.

Efficiency of Resources Used

In estimating efficiency of resources used in cowpea production, the following ratio was used:

r = MVP/MFC

Where:

r = efficiency ratio

MFC = Unit cost of a particular resource

MVP= Value added to cowpea output due to the use of an addition unit of input. The MVP was estimated as follows:

MVP = MPP . Py

Where:

MPP= Marginal Physical Product and

Py = Price of Output.

Decision Rule:

If r= 1: resource is efficiently utilized

r= > 1: resource is over-utilized

r = < 1: resource is under-utilized.

Where r is not equal to (1), it suggests that resources are not efficiently utilized.

Returns to Scale

The elasticity of production which is the percentage change in output as a ratio of a percentage change in input was used to calculate the rate of returns to scale which is a measure of a firm's success in producing maximally.

E_P= MPP / APP

Where:

E_P = Elasticity of production

MPP= Marginal Physical Product ($MPP_{xi} = b_i * Y_t / X_i$)

APP= Average Physical Product

$\sum E_P$=I: Constant returns to scale

E_P= < I: Decreasing returns to scale

$\sum E_P$= > I: Increasing returns to scale

RESULTS AND DISCUSSION

The study revealed that 56% of the sampled farmers were between the ages of 31and 50 years. This indicated that majority of the sampled farmers fall within the middle age which implies that they were still in their active productive age. This should impact positively on cowpea production in the study area. The result relates closely with that of Wakili (2013) who observed a mean age of 37 years for cowpea farmers in Adamawa State, Nigeria. Majority (93%) of the respondents were males, implying that cowpea production in the study area is male gender bias. However, the roles of the female gender may largely have been in the areas of complementary farm operations like harvesting and threshing. Most (89.4%) of the respondents were married. This is a pointer to the level of responsibility on the respondents. A substantial population (45.8%) of the respondents had between 6 and 10 household size. This has implications for farm labour, expenditure and decision making. About 25.4% of the population had no formal education. The implication is that they may still be indulging in traditional farming practices which may not result to optimum yield and ensure sustainable production. The table also shows that 74.6% of the respondents had one form of education or the other. This could have positive effects on cowpea production in the study area, as educated households may not find it difficult to adopt new innovations that will lead to improvement of their production and enterprise sustainability. The nature of farming enterprise of the respondents varied from full time, part time and hobby. About 81.0% and 16.9% engaged in cowpea production on full time and part time basis respectively. This development has implications for enterprise profitability and sustainability. A substantial population (76.1%) of the respondents had above 5 years experience in cowpea production. This implies that majority of the farmers had acquired lots of farming experience which is important in maximizing resource usage, optimizing yield and ensuring sustainable production. Secondary occupation serves as another source of income generating activity aside the primary occupation. These secondary occupations varied from petty trading to construction. About 72% of the respondents were engaged in other occupation. It thus implies that majority of the respondents had diversified their incomes away from farming and are likely to make additional incomes to cater for their family upkeep and farm operations. Family labour accounts for a significant proportion of the total labour force in traditional agriculture and this reduces the cost of hired labour for farm operations. Results from the Table shows that 73% of the respondents were faced with high costs of tractor hiring service, while 48.6% witnessed limited access to improved seeds. This is ironical, given the coverage and success of the on-going Growth Enhancement Support Scheme (GESS) in the country. GESS is a private sector led agro-input initiative where farmers are linked through the electronic wallet (mobile phones) to redeem inputs directly with the agro-dealers at designated redemption centers across the country.

Table 2: Distribution of Respondents According to Socio-economic Characteristics

Variable	Frequency	Percentage (%)
Sex		
Male	132	93
Female	10	7
Marital Status		
Married	127	89.4
Single	7	4.9
Divorced	2	1.4
Widow	6	4.2
Farming Experience		
1 - 5 years	34	23.9
6 - 10 years	65	45.8
11 - 15 years	24	16.9
16 - 20 years	13	9.2
> 20 years	6	4.2
Educational Status		
None	38	25.4
Primary	33	23.2
Secondary	24	16.9
Tertiary	8	5.6
Others	41	28.9
Nature of Farming		
Full-time	115	81
Part-time	24	16.9
Hobby	3	2.1
Farming Experience		
None	1	7
1 - 5 years	19	13.4
6 - 10 years	58	40.8
11 - 15 years	37	26.1
16 - 20 years	26	18.3
> 21 years	1	7
Production Problems		
Limited Access to Seeds	69	48.6
Access to Subsidized Fertilizer	81	57.0
Cost of Hiring Tractor	103	72.5
Poor Soil Fertility	74	52.1
Lack of Storage Facility	74	52.1

Costs and Returns Analysis of Respondents' Cowpea Enterprises

The results in Table 3 show that the costs of labour (₦18,084.20) and tractor hire (₦5,122.60) per hectare accounted for the bulk of the variable cost, put at 52.39% and 14.84% respectively. The total variable cost was estimated at ₦34,517/Ha, while the total revenue stood at ₦ 108, 507.40 /Ha. The estimated gross margin was ₦ 73,991/Ha. This implies that cowpea enterprise in the study area was profitable. The gross margin analysis was used given that the respondents were small scale farmers and their fixed costs were negligible, so, only the variable costs were considered. The result obtained was close to that of Wakili (2013) who observed cowpea production was a profitable business in the study area with an estimated average gross margin of ₦50, 897.12 per hectare. Musa, Vosanka, Inuwa, and Mohammed (2010) also observed a total cost of production of ₦26, 225.00 per hectare while returns was estimated at ₦153, 250.00 for gross income, with gross margin, net income and per naira invested estimated at ₦66, 005.00, ₦37, 380.00 and ₦0.7565.00 respectively. However, Coulibaly and Lowenberg-DeBoer (2002) revealed that only improved cowpea technologies are profitable even under credit constraint. The profitability of cowpea in the study area and the yield potentials from the crop as deduced from trend analysis (Table 1 and Figure 1) thus suggest that cowpea has the prospects for sustainable production development and inclusive growth which will likely support income growth, employment, sustainable livelihood for the generality of rural households and foreign exchange for the country. The outcome of the costs and returns analysis and deductions from cowpea productivity trend analysis (Table 1) support the null hypothesis of this study that cowpea production in the study area is profitable and sustainable.

Table 3: Costs and Returns Analysis of Respondents' Cowpea Enterprises

Variables	Total Amount (₦)	Mean/Farmer(₦)	Mean/Hectare(₦)
Variable Cost:			
Seed	807,140	5,684.08	2,229.60
Labour (Hired)	2,926,493	20,609.10	18,084.20
Fertilizer	742,600	5,229.57	4,051.30
Agrochemicals	1,112,500	7,834.50	3,073.20
Tractor Hiring	1,854,400	13,059.10	5,122.60
Other Costs	356,000	2,507	1,956.00
Total Variable Cost	7,799,133	54,923	34,517
Total Revenue	39,279,700	276,617.60	108,507.40
Gross Margin	31,480,567	221,694	73,991

Source: Field Survey, 2013

Production Function Analysis, Resource Efficiency Measurements and Returns to Scale Analysis

The production function model was used to determine the nature of input-output relationships in cowpea production. Double log production functional form was picked as the lead equation, given the edge it has over other functional forms with respect to the goodness of fit criteria and simplicity to manipulate in efficiency studies. The R^2 value of 0.8913, implies that 89.13% of variations in cowpea production were accounted for by all the independent variables in the model combined together. The calculated F-statistic value of 0.000 implies that there was a significant impact between the dependent variable and the independent variables. The result showed that the regression coefficients of farm size (X_2), labour (X_3), fertilizer (X_4), and

household size (X_6) were positive and significant at 1% level of probability respectively (Table 4), indicating that an increase in these inputs, holding others constant will lead to an increase in the cowpea output.

Table 4: Estimates of Regression Analysis (Double Log Functional Form)

Variables	**Estimates**
Constant	4.8723
	(0. 000)***
Seed (X1)	-0.0506
	(0. 145)
Farm Size (X2)	0.8354
	(0.0000***
Labour Used (X3)	0.08659
	(0. 001)***
Fertilizer Used (X4)	0.2021
	(0.000)***
Agrochemicals Used (X5)	0.0285
	(-0. 353)
Household Size (X6)	0.2441
	(0.000)***
Educ. Status (X7)	-0.0338
	-0.204
Experience (X9)	-0.0292
	-0.452

Source: Field Survey, 2013

F-Value = 0.0000

R^2 =0.89

***Significance at 1% Probability level

Estimated efficiency ratios (r) as shown in Table 5 revealed that the quantities of fertilizer (X_4) and agrochemicals (X_5) used were under-utilized while farm size (X_2) and hired labour used were over-utilized given that the ratios obtained were greater than 1. The under-utilization of fertilizers and agrochemicals are not unexpected given the low utilization of these inputs per acreage. The over-utilization of land and hired labour on the other hand are however contrary to a priori expectations.

Table 5: Estimates of Resource Use Efficiency Ratios (r)

Variable	MPP	MVP	MFC	MVP/MFC	Interpretation
Farm Size (X_2)	703.4132	105,095	5000	21.019	Over-utilized
Labour (X_3)	8.845464	1326.82	700	1.895	Over-utilized
Fertilizer (X_4)	2.372351	68.192	70	0.974	Under-utilized
Agro-chemical (X_5)	0.007938	1191.00	1300	0.916	Under-utilized

Computed from Field Survey Data, 2013

Returns to Scale Analysis

The summation of the regression coefficients (Table 6) revealed a return to scale index of 1.1031, which implies that cowpea production is characterized by an increasing return to scale. The implications of this result is that as respondents' cowpea enterprise expands, it enjoys internal economics of production and as such, it may be able to employ better equipment, sell its products more easily, borrow money cheaply and procure services of more efficient labour, with the view to making more profit.

Table 6: Coefficients of Elasticity of Production

Variables	Coefficients of Elasticity of Production
Seed (X_1)	.1506
Farm Size (X_2)	.8354
Labour (X_3)	.0865
Fertilizer (X_4)	.0021
Agrochemical (X_5)	.2441
Total $\sum$ Ep	1.1031

Source: Field Survey, 2013

CONCLUSIONS AND RECOMMENDATIONS

This study revealed that cowpea production in the study area was profitable and that farm size, labour, fertilizer and household size were significant determinants of cowpea output. The study further showed that production resources were inefficiently utilized. This conclusion tallied with those of researchers like Musa, Vosanka, Inuwa, and Mohammed (2010) and Wakili (2013), who observed that cowpea production was profitable in Nigeria, even though resources were inefficiently utilized. Based on the outcome of this study, the researchers are of the opinion that increasing cowpea production in a

sustainable way will entail that: (i) Niger State Government, through the Extension Component of the State Agricultural Mechanization and Development Authority (NAMDA) promote efficient use of production inputs amongst cowpea farmers with the view to ensuring profitable, sustainable cowpea production and un-locking cowpea inclusive growth potentials within Mashegu Local Government Area; (ii) more farmers in the study area be effectively linked to the on-going Federal Government Growth Enhancement Support Scheme (GESS) by the State Government with the view to enhancing adequate access to production inputs; (iii) the State Government and Mashegu Local Government Council enhance farmers' access to subsidized tractor hiring services within the study area; (iii) the State Government organize literacy campaigns on sustainable cowpea production management practices through NAMDA, with a view to complementing the use of inorganic inputs for cowpea productivity enhancement and profitability in the study area; (iv) the State Government should take advantage of IFAD Adaption for Smallholder Agriculture Programme (ASAP), an initiative that will assist farmers in achieving sustainable cowpea production, amongst other benefits. ASAP is to be implemented under the IFAD Assisted Community Based Agriculture and Rural Development Programme-II proposed for implementation by 2015 in Nigeria; the State Government make provisions for safeguard against negative environmental effect that may likely arise from the use of technologies promoted while managing the resultant social adjustment process.

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