Journal of Agriculture and Sustainability
ISSN 2201-4357
Volume 8, Number 2, 2015, 69-82

Resource Use Efficiency in Small Scale Cowpea Production System in Dawakin Kudu Local Government Area, Kano State, Nigeria

Abdu, Z., Makama, S. A. and K. I. Mika'il

Department of Agricultural Economics and Extension, Faculty of Agriculture, Bayero University, Kano, Nigeria

Corresponding author: Abdu, Z., Department of Agricultural Economics and Extension, Faculty of Agriculture, Bayero University, Kano, Nigeria

Abstract: The study examined the Resource use efficiency in cowpea production in Dawakin Kudu local Government area of Kano State, Nigeria. Multi stage sampling technique was used in the study in which Dawakin Kudu local government area was purposively selected and six villages including Dawaki, Dosan, Tsakuwa, Sarai and Tamburawa were selected using the same procedure. Simple random sampling technique was employed to select 15 small scale cowpea producers in each village making a total sample size of 90 respondents. The data for the study were collected using of structured questionnaire and were analysed using descriptive statistics, farm budget model and multiple regression model. The results of the analyses revealed that majority (53.9%) of respondents were between the ages of 21-40 years. Also 47.7% had informal quranic education while 86.2% were males. Respondents who had 2-10 years of experience in cowpea production constituted 53% while 65% had household size of 2-10 persons and majority (56.9%) had 0.1-1 ha of land. The average total variable cost, total revenue and gross margin per hectare for cowpea production were ₦22, 716, ₦47, 019.3 and ₦24, 303.3 respectively The result from the multiple regression analysis revealed that double-log function gave the best fit with $R^2$of 79.5% and the regression coefficients with respect to farm size, seed and fertilizer were positive and significant while chemical and labour were not significant. Almost all the resources used were over-utilized with only fertilizer which was under-utilized. Incidence of pest and disease, high cost of fertilizer and chemical, problem of flooding and high cost of labour were the major problem affecting cowpea production in the study area .Resource adjustment, provision of extension services, formation of more farmer cooperative societies were recommended.

Keywords: Resource Use Efficiency; Small Scale Cowpea Production System; Dawakin Kudu.

Introduction

Cowpea (*Vigna unguiculata* (L) walp) an annual legume which belongs to the family fabacea and order leguminiseae is a native of central Africa (Rachie 1985, Tayo and Abaka-Ewuse 1988). Cowpea grains are consumed as food and the haulms are feed to livestock as a nutritious fodder and the crop is of major importance to the livelihood of millions of people, providing an opportunity to generate income in addition to increasing soil biological properties through Nitrogen fixation (Quin, 1997,). Due to the great importance cowpea commands nutritionally, great emphasis must be placed on increase in its production.

In Nigeria, the major producing states includes Kano, Jigawa, Gombe, Sokoto Bauchi, Katsina, Yobe and Borno in the North while in the West is Oyo and to the lesser extent in Enugu in the East . Cowpea plays a key role in the Agricultural supply of Nigeria, as the country is the largest producer and consumer of cowpea accounting for about 45% of the world's cowpea production and Kano state is the heart of the Nigeria's "Cowpea Bell" and its is grown almost everywhere in state (Lowenberge-Deboer *et al* 2007).

The increase in human population has necessitated increase in food production for human consumption. These increases in population lead to the increase in demand for food by people in developing countries. Food production must be increased in huge amount to balance the population food demand ratio. According to Stephen *et al* (2004), inappropriate decision to allocate resources, inadequate use of corresponding production input and adoption of improved technologies by farmers, dry-spell and drought during flowering contributes to low output of cowpea in Nigeria. Inefficiency in the use of resources, wrong choice of enterprise combination and cropping system constitutes the major constraints to increased food production in Nigeria(Okorji and Obiechina 1985). According to Ojo *et al* (2008), more efficiency in the use of available resources is a major pivot for a profitable farm enterprise. Hence to increase food production to balance the population food demand ratio, farmers must make efficient

use of resources on their farms and their production enterprise has to be profitable. It is against this background that this research is designed with the following objectives to; determine the costs and returns as well as profitability associated with cowpea production, the resource use efficiency in small scale cowpea production and identify the major constraints associated with cowpea production in the study area.

Methodology

The Study Area

The study was conducted in Dawakin Kudu local government area of Kano state located in the south eastern part of the state. It has an area of 384km^2 and a population of about 225,389 persons (NPC, 2006). The area lies between latitude 11^0 38N and longitude 8^0 33E and mean altitude of 486.5m above sea level. Dawakin Kudu shares boundary with Kumbotso Local Government to the North West and Gezawa Local Government to the North East, Warawa Local Government to the east, Wudil Local Government Area to the South and Kura Local Government are to the South East, Bunkure local government area south west.

Sampling Technique and Sample Size

A multi-stage sampling technique was used in this study in which Dawakin kudu local government area was purposively selected as it is a center for cowpea production and also considering conveniences. Five villages were also purposively selected including, Dawaki, Dosan, Tsakuwa, Sarai and Tamburawa. Simple random sampling technique was used in selecting 13 respondents from each village making a total sample size of 65 respondents.

Data Collection Procedure

The data were collected using structured questionnaires and the information solicited from respondents includes, socio-economic variables such as gender, farming experiences, educational status, household size, and farm size of respondent as well as quantities and prices of inputs as well as outputs in cowpea production, resources used

in the production process and problem encountered by the respondents in their cowpea production activities.

Data Analysis

The data were analyzed using simple descriptive (such as percentage, mean, and frequency tabulation), gross margin analysis and multiple regression models.

The gross margin analysis can be expressed as

GM =TR-TVC ……………………………………………………………. 1

Where GM = Gross margin

TR = total revenue

TVC = total variable cost

Return on Capital Invested (RCI) is given by:

$$RCI = \frac{GM}{TVC} \quad \ldots\ldots 2$$

Where RCI = Return on capital invested

GM = Gross margin

TVC = Total variable cost

The multiple regression analysis was used to determine the resource use efficiency in cowpea production and the nature of returns to scale. The data were subjected to the following production functions including linear, semi-log and double log. The model that best fit the data will be selected based on sign and magnitudes of the coefficient, the magnitude of R^2, t- statistics, f- statistics (Rahman, 2003). The models are specified as follows.

The linear multiple regression model can be specified as follows:

$$Y = a_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + \mu \ldots\ldots 3$$

The semilog function of multiple regression model can be specified as follows:

$Y = a_o + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + \mu$ ……4

The cobb – Douglass (or Double log) function is expressed as

$\text{Log } y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + e + b_5 \log x_5 + \mu$ ……5

Where Y = output of cowpea (kg)

X_1 = farm size (in hectare)

X_2 = quantity of seed (kg)

X_3 = quantity of fertilizer (kg)

X_4 = pesticide (litres)

X_5 = amount of labour used (in man day)

U = error term (stochastic or noise, or disturbance term)

$B_0 – b_5$ = regression coefficient

The regression coefficient estimates were used to calculate the marginal value product of inputs used in production. It was expressed as;

MVP= MPP. Py

Where; MVP = marginal value product of ith resources

Marginal physical product(MPP) = regression coefficient of ith resources

Py = unit price of output (₦)

The marginal factor cost (MFC) was also estimated. It can be expressed as

$MFC = Px_i$…….

MFC = marginal factor cost

Px = unit price of ith input

The MVP/MFC ratio was used in calculating resources use efficiency.

r = MVP/MFC

Decision rule;

If r = 1 resource is efficiently utilized

r > 1 resource is under utilized

r < 1 resource is over utilized

Where MVP = MFC Economic optimum takes place

Results and Discussion

The distribution of respondents according to socioeconomic Characteristics is presented in Table1.The table revealed that 30.8% of the respondents fall within the age of 31-40 years of age, 24.6% fall within the age of 41-50 years. The minimum age of the respondents was 17 while maximum age was 80 in the study area. It clearly shows that majority of the producer were young and within their active and productive stage. The table also revealed that majority (86.2%) were males which agrees with the findings of Ojo *et al* (2008) who reported that 85% of the cowpea producers in his area of study were males. However figure was higher than the 52.05% reported by Stephen *et al* (2004) for cowpea producers in the Northeast zone of Adamawa state. Therefore males dominated cowpea production activities in the study area. The table also shows that 47.7% had informal Quranic education, 23.1% had primary education and 29.3% had both secondary and tertiary education. In terms of farming experience, about 75.5% of the respondents had farming experience between 1-20 years in cowpea production, these has great influence on production efficiency. This means that most farmers in the study area have adequate farming experience in cowpea production. The household size of the respondents is shown in the table revealed that 65% had household size of 2-10 persons while 31% of the respondents had 11-20 persons implying that the respondents had average availability of family labour to supplement hired labour.. As shown in the table 56.9% of the farmers devoted 0.1 - 1 ha for cowpea production, whereas 26.2% of the respondents devoted farm size of 1.2 - 2 ha which suggests the small scale nature of cowpea production in the study area. The mean farm size was 1.3ha which is lower than the 1.8ha reported by Stephen *et al* (2004) for cowpea producers in the northeast of Adamawa state.

Table 1: Socio-Economic Characteristics of the Farmers in the Study Area

Variables	Frequency	Percentage
Age		
21-30	15	23.1
31-40	20	30.8
41-50	16	24.6
51-60	06	9.2
61-70	06	9.2
71-80	02	3
Gender		
Male	56	86.20
Female	09	13.8
Household Size		
1-10	42	65
11-20	20	31
21-30	03	4.6
$\bar{X}$**= 10 years**		
Education		
Primary Education	15	23.1
Adult Education	5	5.56
Secondary Education	12	18.5
Quran Education	31	47.70
Tertiary Education	07	10.8
Experience		
1- 10	35	53.90
11- 20	14	21.60
21- 30	13	20.00
31 - 40	03	4.60
$\bar{X}$**= 14 years**		
Farm Size		
0.1 – 1.0	37	56.90
1.2 – 2.0	17	26.20
2.4 – 4.4	11	16.90
$\bar{X}$**= 1.3 hectares**		
Total	**90**	**100.00**

Costs and Returns Analysis

The average cost and returns associated analysis for cowpea production among the respondents is presented in Table 2. As shown in the table that fertilizer cost accounted for about 40.5% of the average totals variable cost of production which is higher than the 28.97% reported by Ojo *et al* (2008) for cowpea producers in Niger state. The average total variable cost per hectare was ₦22, 716.00which is slightly higher than th average total variable cost of N19,236.40/ ha incurred by cowpea producers in Niger state reported by Ojo et al (2008). It is also in contrast with findings of Omonona et al (2010) who reported the average total variable cost of production per hectare as ₦18,720.29 for cowpea producers in Osun state. However his variation can be attributed to high cost of inputs especially fertilizer in the present study area. The average total revenue and gross margin per hectare were ₦47,019.3 and ₦24,303.3 respectively is left as gross margin this figure is lower than the ₦62, 258.30 and ₦43,537.51 as average total revenue and gross margin per hectare respectively realized by cowpea producers in Osun state reported by Omonona et al (2010).However the average total revenue realized by the farmers agrees with the findings of Ojo et al (2008) who reported N47,300.00 as average total revenue realized by cowpea producers in Niger state, however the gross margin of ₦28,063.00 realized was higher than what was obtained by the cowpea producers in the present study. The positive gross margin indicated that returns far superseded the costs which revealed that cowpea production is profitable which is in line the findings of Ojo et al (2008) and Omonona (2010) whom in their separate studies reported that cowpea production is profitable. The average rate of return on investment was ₦1.1. This means that for every ₦ 1.00 invested in producing one kilogram of cowpea, ₦1.1 was realized.

Table : Costs and returns Associated with Cowpea Production in the Study Area

Variable	Average cost (₦)/Ha	Percentage of total cost
Cost of seed	1358	6%
Cost of family labour	4,651.9	20.5%
Cost of hired labour	5,405	23.8%
Cost of fertilizer	9,201.8	40.5%
Cost of chemical	1,854	8%
Cost of empty bag	245	1.1%
Total variable Cost	22,716	100
Total revenue (GI)	47,019.3	
Gross margin (GM)	24,303.3	
Return per naira invested	1.1	

Cowpea Production Function Estimates

To examine the technical relationship between output and the various input used in cowpea production, the production function was estimated. Three functional forms were fitted into the model. These include linear, semi-log, and double-log. The selection of the lead equation was based on the comparison of the value of the coefficient of multiple determinations (R^2), statistical significance of the coefficients of the variables and the signs of the parameters estimated. Based on these criteria the double-log was chosen as the lead equation as it best fit the data.

The result of the multiple regression analysis for double log function is shown in Table3. As shown in the value of R^2 was 0.795 (79.5%) which implies that 79.5% of the total variation in the output realized in cowpea production was explained by the various inputs used. The remaining 20.5% not explained by the explanatory variables which could be attributed to the error or random disturbance in the model. The F-value of 34.176 was significant at 0.1%, indicating that the variables included in the model adequately explained the variations in output. The regression coefficient with respect to

farm size, seed and fertilizer were positive and significant implying that a unit increase in any of the three variables inputs in cowpea production holding all other explanatory variables constant will lead to an increase in the output. This agrees with the findings of Ojo et al (2008) and Omonona *et al* (2010) who reported in their separate studies that farm size, seed and fertilizer had significant influence on output. As shown in Table4 the regression coefficient with respect to chemical and labour were negative but not significant and contradicts the findings of Ojo *et al* (2008), Stephen *et al* (20004) and Omonona *et al* (2010) whom reported positive and significant regression coefficient with respect to labour and chemicals.

Table 4. Double log Production Function Estimates

Factor input	Regression coefficient	t –value
Constant	1.623	3.960
Land	0.459	2.690**
Seed	0.360	2.625*
Fertilizer	0.449	3.615**
Chemical	-0.017	-0.168^{NS}
Labour	-0.224	-0.992^{NS}
R^2 value = 0.795		
R^2 adjustment = 0.772		
F- value = 34.176***		

*** = Significant at 0.1%, ** Significant at 1%, * Significant at 5%, ^{NS} = Not significant

Resources Use Efficiency

The resource use efficiency among the the cowpea producers is presented in Table4. As shown in the table all inputs were inefficiently utilized as the ratio of MVP to the MFC were not equals to unity. Fertilizer was under- utilized the efficiency ratio was greater than unity while farm size, seed, labour and chemical were over-utilized as

their respective efficiency ratios were less than one. However the use of chemical was not rational given the negative ratio, this means that cowpea output was likely to increase and hence revenue if more of fertilizer had been utilized efficiently. This findings agrees with the findings of Omonona *et al* (2010) who reported under utilization of fertilizer among the cowpea producers in Osun state but reported under utilization of seed, labour and chemicals which contradicts the over utilization of these resources reported in the present study. The findings is contrary to the findings of Ojo *et al* (2008), who reported that farmers in Niger state over utilizes fertilizer and under utilizes farm size, seed and labour. Therefore for the farmers in the study area to obtain optimal allocation of resources, fertilizer input must be increased.

Table 4. Estimated Resources-use Efficiency in Cowpea Production

Inputs	MVP	MFC	MVP/MFC
Farm size	114.75	5000	0.02
Seed	90	500	0.18
Fertilizer	112.25	45	2.49
Chemical	-4.25	700	-0.0061
Labour	-56	200	-0.28

Elasticity of Productive Rsources and Returns to Rcale

The elasticities of production and returns to scale in cowpea production is presented in Table5 .However ,the regression coefficient withrespect to each variable input in the double-log function is equals to its elasticity in production. The sum of elasticities was 1.027 which is greater than 1, implying that the farmers were operating at the region of increasing returns to scale.At this point, an additional unit of input results in a larger increase in product than the proceeding unit. However the value for returns to scale was lower than the 14.383 reported by Ojo *et al* (2008)

Table5. Estimated Elasticities of Production and Returns to Scale

Variables	Elasticity of production
Land	0.459
Seed	0.360
Fertilizer	0.449
Chemical	-0.017
Labour	-0.224
Return to scale	1.027

Sources; field survey 2011

Production Constraints Faced by Cowpea Producers in the Study Area.

The constraints to increased cowpea production in the study area are presented in Table 6.The table revealed that 61.54% of the respondents were faced with high cost of fertilizerm while 40% of the respondents complained about high incidence of pest and disease. Respondents who acknowledged lack of capital as a constraints constituted 16.92% while 43.08% acknowledged high cost of transportation.

Table 6: Constraints Associated with Cowpea Production in the Study Area.

Constraints	Frequency	Percentage
High incidence of pest and diseases	26	40
High cost of fertilizer	40	61.54
Inadequate capital	11	16.92
Inadequate storage facilities	6	9.23
Inadequate extension services	13	20
High cost of machinery	2	7.08
Unstable market prices	10	15.38
High cost of Transportation	28	43.08
Problem of flooding	7	10.77

Conclusions

Based on the findings of the study, it was revealed that majority of cowpea farmers in the study area were in their active age, well experienced in cowpea production, with little western education and male dominated. The result shows that cowpea production in Dawakin Kudu local Government of Kano is profitable. Cowpea producers were not allocating their resources efficiently. It was found that cowpea production was faced with some constraints such as high incidence of pest and disease, high cost of fertilizer and chemical as well as inadequate of capital

Recommendations

Based on the findings there is a need for Government and private sector to provide inputs at an affordable price through farmer's association. Farmers should be encouraged to form cooperative societies, so as to take advantage of bargaining power in the input and output market, which will in turn increase farmers, input purchasing power. Resource adjustment is recommended as the farmers were using the resources inefficiently.

References

[1] Lowenberg-Deboer, J, Germaine, I. and Musa S. A. (2007), Kano State Cowpea Subsector Study. Trip Report; February 3 to 16 and March 8 to15, 2007, West Lafayette, International Programme in Agriculture, Purdue University, 2007.

[2] National Population Commission (2006). National Census Data. http//www.Npc.Goov.Mg. 15-04-012

[3] Ojo, M. A., Salami, A. E., and U. S. Mohammed(2008).Profitability, Input Elasticities and Resource Use Efficiency in Small Scale Cowpea Production in Niger State, Nigeria. *Journal of Agriculture and Social Research* 8(2): 1-7 pp

[4] Okorji, E. C. and Obiechina, C. O. B (1985).Basis for Farm Resource Allocation in Traditional Farming System. A Comparative study of Productivity of Farm Resources in Abakaliki Areaof Anambra State. *Agricultural Systems* 17: 197-210

[5] Omonona, B. T., Egbetokun, O. A. and Akanbi, A. T.(2010). Farmers resource use and Technical Efficiency in Cowpea Production in Nigeria. *Economic Analysis and Policy* 4(1): 87-96 pp

[6] Quin F. M. (1997). Introduction. In: Singh, B. B., Mohan Raj, D. R. Dashiel, K. E. and Jakai, L. E. N.(eds). Advances in Cowpea Research. Proceedings of the second World Cowpea research Conference held at Accra, Ghana 3-7 September, 1995. Proceedings series No.2 IITA Ibadan, Nigeria and JIRCAS, Tsukuba,Ibaraki, Japan.

[7] Rachie, K.O, (1985), Introduction in; Singh, S,R, Rachie, K.O (Eds). Proceedings Cowpea Research, production and utilization, John,W and sons, Chichester, London 290-292

[8] Rahman S. A. and Lawal, A. B. (2003). Economic Analysis of Maize based Cropping System in Giwa Local Government Area of Kaduna State, Nigeria. *An International Journal* of *Agricultural Sciences, Science, Environment and Technology* 3(2): 139-148

[9] Stephen, I. , Mshelia, S. I. and Kwaga, B. T.(2004). Resource Use Efficiency in Cowpea Production in the North East Zone of Adamawa State. http://www.josdae.com/papers /vol 203.pdf 25-4-2012

[10] Tayo, T. O. and Abaka-Ekwusi, K.(1988). Effect of Water Stress on Performance of Cowpea (*Vigna unguiculata* (L.) Walp) . *Journal of Arid Agriculture*. 1(1). 69-78pp