PROFITABILITY ANALYSIS AND RESOURCE USE EFFICIENCY IN TOMATO PRODUCTION IN KANO STATE NIGERIA

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Abstract

The study examined the profitability and resource use efficiency in tomato production in Kano State Nigeria. Multi–stage sampling technique was used to select one–hundred and twenty tomato farmers for the study. Data were obtained with the aid of structured questionnaire and interview schedule. Descriptive statistics, production function, marginal value productivity and farm budgeting analysis wereemployed in the analysis of the data. Results showed that themeanage was 33 years. The average household size was 11 people, about three quarter (75 %) of farmers cultivate less than 1.6 ha of land. Farm size of farmers ranged between 0.5 ha to 2.0 ha. The results of Cob Douglas production function showed that farm size was positive and significant at 5 % level of probability. The coefficient for labour was negative and significant at 10 % level of probability.The findings also revealed that all the variable inputs except labour have efficiency ratio greater than unity.This implies that most of the inputs were underutilized in the production of tomato.The result revealed that an average net farm income of ₦46,399.00 per hectare was accrued to tomato production. The average rate of return was 32 % i.e. for every naira invested 32k is generated as revenue. The study therefore, recommends that policy attention should be directed towards providing labour saving technology to ease farm operations and reduce cost of production.

Keywords*: Profitability, tomato, resources, efficiency, Kano State.*

INTRODUCTION

One of the main reasons for low productivity in agriculture all over the world is the inability of farmers to fully exploit the available technologies, resulting in lower efficiencies of production. This fact has been emphasized in many studies (Villano & Fleming, 2006; Mehmet & Ceyhan, 2007). The question of efficiency in resource allocation in traditional agriculture is not trivial. It is widely held that efficiency is at the heart of agricultural production. This is because the scope of agricultural production can be expanded and sustained by farmers through efficient use of resources (Ali, 1996). For these reasons, efficiency has remained an important subject of empirical investigation particularly in developing economies where majority of the farmers are resource–poor.

The policy–makers have been trying to identify and suggest ways to eliminate the constraints on the adoption of new technologies (Ajibefun *et al.*, 1996). The importance of the efficient use of available technology is seldom realized by policy makers. It is being assumed, erroneously by policy–makers, that farm–owners can operate the existing technology efficiently, but cannot make a rational choice among the various technologies. Unless the potential of an existing technology is completely exploited, benefits from new technologies may not be realized to the full extent (Vijay, 2002).

Tomato is an important vegetable crop in Nigeria where it is used in soup preparation and salad in homes and hotels (Olaniyan *et al*., 2007). Despite the importance of tomato in the nutrition of people its production is very low as most farmers do not efficiently utilized input its production.In a bid to help farmers increase productivity, the focus is usually on whether farmers are using better and improved technologies. It is however necessary to investigate whether these farmers are even making maximum use of what is available to them in terms of inputs. As farmers aim at maximizing profit whiles minimizing cost, it is pertinent to determine the efficiency of resource use.The study therefore assess the socio–economic characteristics of tomato farmers in the study area, determine the production function with the purpose of obtaining resource use efficiency and determining the cost and return in tomato production in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted in Kano state Nigeria. Kano state is approximately located between latitude $10^0 35'$ and $13^0 02'$ north and between longitude $7^0 30'$ and $10^0 35'$ east and as such it is part of sudano–sahelian zone of Nigeria (Olofin *et al.*, 2008). It shares boundaries with Jigawa State to the north east, Bauchi State to the east, Katsina State to the north–west and Kaduna State to the south. Kano has a total land area of 43000 kilometres square. According to

NPC (2006), the state has a population of 9.4 million with 446 person/km^2 density. The estimated population as at 2008, 2009 and 2010 will be 9.88, 10.11 and 10.36 million, respectively at 2.5 % annual increase. The annual rainfall of the state ranges between 420 mm to 1000 m and temperature is averagely warm throughout the year at about 27^0C ± 7^0C. The natural vegetation of the environment is Sudan Savannah which is tropical grassland with scattered trees such as baobao, acacia and locust bean trees (Olofin & Tanko, 2002).

Sampling Technique and Data Collection

A multi–stage sampling technique was used for this study. In the first stage, thirty six villages were identified from the three zones i.e. 12 villages from each zone in the state. The second stage involved random selection of four villages of tomato farmers from each zone and these constituted a population of 600 tomato farmers. The last stage involved proportionate random sampling of 120 tomato farmers using 20 % of the population of tomato farmers in each village. Primary data were used for this study and these were collected with aid of structured questionnaire and interview schedule. Information was collected on socio–economic characteristics of the farmer such as age, educational status, household size, farming experience, farm size, etc. Farm production data: Such as land area cultivated (ha), variety of tomato grown, amount and cost of labour used per ha, quantity and cost of inputs, quantity and price of output were also collected.

Analytical Technique

The analytical tools used in this study include the following:

(i) Descriptive statistics
(ii) Farm budgeting
(iii) Production function analysis

Descriptive Statistics

These are in form of measures of central tendencies; such as mean, median, mode, frequency distribution, percentages, etc. and measures of dispersion; such as range, standard deviation, etc.

Farm Budgeting

Here one of the budgeting techniques the net farm income was used to evaluate the cost and return to obtain a net profit. It represents the difference between the value of output and total cost. It is simply calculated as the difference between the total revenue and the total cost which is expressed as follows:

NFI=TR–TC ..... (1)

NFI = Net Farm Income (N)
TR = Total Revenue (N)
TC = Total Cost (Variable Cost + Fixed Cost) (N).

Production Function Analysis

A production function expresses the physical relationship between inputs and outputs in a production process. Specifically the general form of the model is as follows:

$Y=F(X_1,X_2,X_3,X_4,X_5,X_6,X_7,u)$ .....(2)

Where:
Y = Output of Tomato (kg)
X_1 = Farm size (Ha)
X_2 = Quantity of Fertilizer (Kg)
X_3 = Quantity of Manure (Kg)
X_4 = Labour (Man –hour)
X_5 = Seeds (Kg)
X_6 = Amount of water used (litre)
X_7 = Chemicals used (litre)
u = Error term.

Marginal productivity and resource use efficiency

The marginal value product (MVP) of the resources used was estimated by multiplying the marginal physical product and the prices of the input. The value was then compared with the cost of the resources, i.e. Marginal Factor Cost (MFC) or Unit factor cost (UFC) in order to make inference on efficiency of resource use. The following was estimated to determine the efficiency of resource use:

r = MVP/MFC .....(3)

Where:
r = efficiency ratio
r = 1 means resources employed by the farmer are efficiently utilized.
r>1 means resources employed by the farmer are under–utilized
r<1 means resources employed by the farmer are over–utilized

The efficiency of the input occurs when

$MVPx_i=MFC=Px_i$ .....(4)

Where:
MVP_{yi} = $MPPx_i$. Py
MFC = UFC = Px_i
Px_i = unit price of extra variable input x
Py = unit price of output
MPPxi = marginal physical product of input xi
MVP = marginal value product of output
MFC = marginal factor cost ($\Delta TC/\Delta x_i=Px_i$)

RESULTS AND DISCUSSION

Socio–economic characteristics of tomato farmers in the study area

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It was revealed that the farmers' age ranged between 21 and 70 years. Majority of farmers (83 %) were between the ages of 30–50 years. Only 6 % of the farmers were 51 years and above.The mean age was 33years. This implies that majority of the farmers were in the middle or active age group. The result obtained is similar to the findings of Muhammed

(2010), which states that majority of vegetable growers are below the age of fifty and therefore still in their active age.It was revealed that the farmers in the study area had one form of education or the other. This implies that the literacy level among the farmers in the study areas is relatively high which makes it very likely for the two groups of farmers to use emerging opportunities adopt new innovations. The results also showed that the size of the households in the study area ranged between 5 and 25 people. Majority of the (50 %) had 6 to 10 people in the household respectively. The average household size was 11 people. The reason for large household size in the study areas may be connected with the religious influence and type of family system practiced in the area. Furthermore, it was discovered that the 42 %of the farmers had 21–30 years of farming experience. Only 15 % had less than 11 years of farming experience. The average farming experience for was 19years. The implication of this finding is that experienced farmers are more likely to make sound decision that will increase his output, income and savings (ceteris paribus). The findings revealed that more than three quarter (75 %) of farmers cultivate less than 1.6 ha of land. Farm size of farmers ranged between 0.5 ha to 2.0 ha. This implies that tomato farmers in the area were predominantly small scale farmers. This is because majority of the farmers have small farm size resulting from inheritance or hire. Small farm size is an impediment to agricultural mechanization because it will be difficult to use farm machines on small and fragmented individual farms. The mean farm size is 1.21 ha.

Table 1: Socio–economic characteristics of tomato farmers in the study area

Variables	Frequency	Percentage
Age group (yrs)		
21–30	13	11
31–4	52	43
41–50	49	41
51–60	4	3
61–70	4	3
Level of Education		
Primary Education	8	28
Secondary Education	10	20
Tertiary Education	5	7
Non–formal Education	33	45
Household Size		
1–5	1	2
6–10	30	45
11–15	16	25
16–20	7	10
Above 20	12	18
Farming Exp. (yrs)		
1–10	10	15
11–20	20	30
21–30	28	42
31–40	2	3
Above 40	6	10
Farm Size (ha)		
<1.0	30	46
1.0–1.5	29	44
1.5–2.0	7	10
Total	**120**	**100**

Production function analysis (Regression)

In order to determine the nature of the technical relationship between inputs and outputs, multiple regression models using ordinary least square (OLS) were used. Different functional forms were fitted to the input–output data. However, Cobb–Douglas (double log) production function was selected as lead equation or line of best fit. This was based on the magnitude of the coefficient of multiple determinations (R^2), the appropriateness of the signs of the estimate, significance of the t–values, standard errors and over all significance of the f–value which determines the strength of association between the dependent and independent variables. According to Koutsoyiannis (1977), the smaller the standard error, the stronger is the evidence that estimates are statistically significant. He further affirmed that if, the observed t–value is greater than 2 (or smaller than –2), then we reject the null hypothesis and if, on the other hand, the observed t–value is smaller than 2 (but greater than –2), we accept the null hypothesis. The results of the Cobb–Douglas function of the farmers presented in Table 2 showed that R^2 value which measures the proportion of the variation in dependent variable Y that is explained by the independent variables was 55 % while R^2–adjusted was 50 %. The F–values was 53 which was significant at 1 % level of probability and this implies that the independent variables included in the model were all important in explaining the variations in the dependent variables.

Farm size was 0.486 positive and significant at 5 % level of probabilitymeaning that an increase in farm size of farmers by one unit will bring about an increase in yield performance by 0.49 unit/ha. There was a priori expectation for fertilizer to be positive and significant in the model but it only turned out to positive but not significant. Manure was 0.471 positive and significant at 5 % level of probability, meaning that an increase in manure by one unit will bring about an increase in yield of tomato by 0.47 unit/ha. The coefficient for labour was 0.25 negative and significant at 10 % level of probability ($P \leq 0.1$), meaning that decrease of labour by one unit will bring about an increase in tomato yield by 0.25 unit/ha. This resource is overutilised. The use of seeds by the farmers was 0.72 positive and significant at 1 % level of probability ($P \leq 0.01$), meaning an increase of seeds by one unit will bring about increase in tomato yield by 0.72 unit/ha. Furthermore, the coefficient obtained for chemical was positive and significant at 10 % level of probability ($P \leq 0.10$). Meaning that 1 unit increase in this variable will result in increase of the yield of tomato by 0.23 unit/ha.

Table 2: Result of production function analysis (Regression)

Variables	Coefficient	Standard error	t–value
Constant (a)	3.453	0.477	7.239
Farm (X_1)	0.486**	0.160	3.040
Fertilizer (X_2)	0.192	0.226	0.848
Manure (X_3)	–0.418**	0.137	–3.039
Labour (X_4)	–0.249*	0.137	–1.815
Seeds (X_5)	0.720***	0.124	5.792
Chemical (X_7)	0.421**	0.115	3.661

R^2 = 55 %; R^2adj = 50 %; F–value = 53***; *Significant at 10 %; **Significant at 5 %

Marginal productivity and resource use efficiency of tomato production in the study area

The results presented in Tables 3 showed the marginal productivity, efficiency of resources–used of tomato production in the study areas. It was observed that the entire variable inputs except labour (–3.5) have efficiency ratio greater than unity i.e. labour was overutilsed by this group of farmers. This implies that most of the inputs or resources were underutilized in the production of tomato the farmers. This may be due to high costs and unavailability related to some of these inputs in the study areas.

Table 3: Marginal productivity and resource use efficiency of tomato production in the study area

Variable inputs	X	MPP	MVP	UFC	MVP/UFC
Farm size (ha)	1.21	2309	115475.21	5000	23.09
Manure (kg)	3000	0.904	45.17	2	22.59
Fertilizer (kg)	150	0.73	80	36.72	0.46
Labour (mn–hr)	459	–3.119	–155.96	110	–1.417
Seeds (kg)	0.12	34507	415000.00	22500	16.6
Chemicals (lit)	5	265.42	2604.00	1100	2.36

Analysis of costs and returns to tomato production in the study area

In estimating the costs of production, both fixed and variable costs were considered. The fixed costs consist of land rent, depreciation on water pumps, basket, hoes, farm implement and interest on capital. The variable cost components consist of cost of seeds, labour, fertilizers, manure and chemicals (Table 4). The total cost of production was ₦143,271.00. The cost of capital was ₦39,910.00 per every ₦100,000.00 and most labour used by farmers using is manual (family and hired).

Table 4: **Net farm income and average rate of return**

Cost in Naira	Variable inputs
Seeds (kg/ha)	6188.00
Manure (kg/ha)	6000.00
Labour (man–hour/ha)	50490.00
Irrigation water (litres/ha)	7313.00
Petrol (litres/ha)	3250.00
Interest on loan/year/ha	39910.00
Fertilizer (kg/ha)	12000.00
Chemicals (litres/ha)	5250.00
Total variable costs (A)	**130401.00**
Fixed inputs:	
Irrigation pump*****	8000.00
Hoe *****	100.00
Basket *****	100.00
Land rent******	5000.00
Total fixed costs (B)	**13100.00**
Total cost (A+B) =C	**143501.00**
Revenue* (D)**	**190000.00**
Net farm income (D–C)	**46499.00**
Average rate of return (NFI/TC)	**0.32**

*******Revenue is calculated on the basis of average price of ₦40/kg taken between February–May and October–December 2009; ******Per annum

***@** 33.33% Dep/annum; **Source:** Researcher's Computation, 2010.

Total variable cost

The total variable costs of tomato farmers were cost of seed, manure, fertilizers, chemicals and labour. Average variable cost per hectare of ₦130,401 was incurred on tomato production by farmers. This accounted for 91 % of the average total cost for tomato production (Table 4). The result obtained is similar to the findings by Sintiki (1990), who concluded that the variable costs constituted 90 % of the total cost of production. The result further revealed that labour constitutes 39 % of the total variable costs; 35 % of the total costs. This indicates that labour is the most used input. However, the total variable costs of farmers

Total fixed cost

The total fixed cost consists of land rent, depreciation on baskets, hoes and implements. The average fixed cost was ₦13,200.00. This represents 9%of the total cost of tomato production per hectare (Table 4).

Gross return

Gross return was obtained by multiplying the total output of tomato by the unit price. Average price of tomato per kilogram in the study areas was determine by taking prices between February–May and October–December, 2009 and was found to be ₦40.00. The result showed that the average returns on tomato production in the study areas by farmers was₦190,000.00.

Net farm income and average rate of return

This represents the difference between the value of output and total cost. The result revealed that an average net farm income of N46,399.00 per hectare accrued to tomato farmers. The result further showed that tomato production is profitable in the study areas. The average rate of return analysis showed 32 % i.e. for every naira invested by 32 k is generated as revenue (Table 4), meaning that, tomato farming is more profitable in the study area.

CONCLUSION

Based on the findings of this study, it is concluded that tomato farmers are in their middle ages. Similarly, it was found out that most of input resources used by the farmers were underutilsed. It was also apparent from the findings that tomato production by the farmers within the limited resources is profitable. It is therefore recommended that tomato farmers in the study areas should form cooperative societies in order to address some of the problems they encounter during production and marketing of their tomato. Labour was identified as the major input in tomato production in the study area. Therefore policy attention should be directed toward providing labour saving technology to ease farm operations and reduce cost of production.

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