

Resource use Efficiency of Irrigated Tomato Production in Northern Part of Taraba State, Nigeria

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Abstract – The study examine resource use efficiency of irrigated tomato production in Northern Taraba State, were irrigated tomato production is predominantly grown. One hundred and four farmers were selected using a multi stage, purposive and simple random sampling techniques. The result of the analysis revealed that 96% of the variation in irrigated tomato output was due to difference in technical efficiency. The mean technical efficiency (TE) is 0.89 (89%) which indicated that tomato farmers in the study area are not fully efficient because they operated below the frontier level. The result of the analysis further showed that farm size, fertilizer and insecticides were the major factors that influenced output of the crop and are all statistically significant at 1% level. The results indicated that the farm size was under-utilized since the ratio exceeded unity while Fertilizer and insecticide were over utilized because the estimated efficiency ratios differed from unity. Base on the finding the researchers wish to recommend that access to credit by farmers should be guaranteed by the State Government through special programs to enable farmers acquire more productive modern inputs as well as other cost – elements in the production process.

Keywords – Resource Use Efficiency, Irrigated, Tomato, Production, Stochastic Frontier.

I. INTRODUCTION

Tomato is one of the most essential vegetables in Nigeria. In Nigeria, for over two decades (1970-1992) vegetables (notably) tomato production has been on the increase with the exception of the period 1976- 1981 and 1983 when extreme drought was experienced [1]. Tomato is the most popular home garden and the second most consumed vegetables after potato in the World [2]. It is mainly grown under irrigation in the northern part of Nigeria during the cool and dry hamarttan period [3]. Today, tomato is cultivated is cultivated almost throughout Nigeria and the most important areas lie between 7.5° N and 13° N mostly around urban areas in the Northern and Southern – Western parts of the country. The principal areas of tomato production include Zaria, Kaduna in Kaduna State, Jos in Plateau State, Gombe in Gombe State, Ilorin in Kwara State, Sokoto in Sokoto State, Maiduguri in Borno State, Ogbomosho in Osun State and Ibadan in Oyo State [4].

It is essential to note today, that Fadama which is ideal for irrigated crop production is responsible for supplying food to millions of people in Nigeria [5]. Traditionally, many families cultivate small areas of fadama during dry season using water drawn manually from shallow wells or streams [6]. Erahbor (1982), in [7] reported that such

simple but relatively cheap system had brought higher returns to crop production. Tomato is an important source of income and diet [8]. It supplies vitamins, minerals, fibres and is of high nutritional values. It also contains health benefit anti-oxidants such as lycopene for cancer prevention especially those of the prostate gland, long and stomach [3]. Sainju and Dris [2] also reported that tomatoes are rich in nutrients and are eaten raw, stewed, fried or baked and its consumption can significantly reduce the risk of developing colon, rectal, prostate and stomach cancer.

Interestingly, the production and the land devoted to tomato production are on the increase. The area cultivated rose from 38,000 hectares in 1995 to 55,000 hectares in 1997 with a corresponding production increase from 569,000 metric tons to 570,000 metric tons in the same period [9].

Taraba is one of the northern states in Nigeria producing tomato through irrigation system. The potentials of the State for irrigated tomato have not been fully exploited. Out of the 126,000 hectares of irrigable land only, 1,500 hectares had been developed. Production yields too had not increased appreciably in 2005, only 38,380 metric tons of tomato were produced as compared to the 37,170 metric tons produced in 2004 [10]. Therefore, the majority of irrigated tomato producers fail to exploit fully the potential of present technology and they are inefficient in irrigated tomato production. The objectives of this study are to:

- 1) Estimate frontier production function of respective irrigated tomato farmers in the study area.
- 2) Determine the resource use efficiency of irrigated tomato production in the study area.
- 3) Identify constraints faced by irrigated tomato farmers in the study area.

II. METHODOLOGY

The study was carried out in the northern part of Taraba State. Primary data were the major source of data used in this study. A multi stage, purposive and simplerandom techniques were used for the selection of the study area because of its relevance in irrigated tomato production in the state. Three local government areas (LGAs) were also purposively selected because of its importance in tomato production in the northern part of the state. Three wards were purposively selected from each of the LGA based on their relevance to irrigated tomato production. In all nine wards were covered for this study. Farmers were selected using from each ward using simple random procedure on

the basis of proportional allocation. A total of 104 respondents were reached using a structured questionnaires from which relevant information were obtained. The most serious problem facing the farmers was pests and diseases which accounted about 16.53% of the respondents. This is in consonance with Mshelia et al [1] who reported pests and diseases as the major (21.29%) constraints militating against vegetable production among farmers on Lake Geriyo in Adamawa State

III. DATA ANALYSIS

The analytical tools used for achieving the objectives of this study were descriptive statistics and stochastic frontier production function. The descriptive statistics used include means, frequencies, Tables and percentages. These were used to analyze the constraints facing irrigated tomato farmers in the study area. The stochastic frontier production function was used to estimate the frontier production functions of efficient technology of respective irrigated tomato farmers. The coefficients (β_1, β_6) were used to compute the marginal value product (MVP) for some inputs. The marginal factor costs (MFC) for each input were also computed.

Analytical Measurement in Technical Efficiency

The efficiencies of individual observations farmer are estimated by parametric approach using a stochastic frontier production function. The basic concept of this function by Agner, Lovell and Schmidt [11], Meeusen and Van Den Broeck [12] was applied in this study. The stochastic frontier model for irrigated tomato farmers in the study area is explained by:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + (v_i - u_i) \dots (1)$$

where Y_i = average tomato output (kg/ha)

X_1 = total farm size under cultivation (ha)

X_2 = Seed used (kg/ha)

X_3 = fertilizer used (kg/ha)

X_4 = hired labour (man days/ha)

X_5 = insecticide used (litres/ha)

X_6 = family labour (mandays/ha)

\ln = logarithm to base e

i, j = j^{th} observation of the i^{th} farmer

$V_i - U_i$ = error term (ϵ)

β_0 = constant term to be estimated

β_1 to β_6 = coefficients of the independent variables to be estimated

$$\mu_{ij} = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 \dots (2)$$

μ_{ij} = denotes the technical inefficiency of the i^{th} farmer

Z_1 = denotes gender

Z_2 = represent age

Z_3 = represent years of formal education

Z_4 = denotes years of farming experience of the i^{th} farmer

Z_5 = represent family size

δ_0 = constant term

δ_1 to δ_5 = unknown parameter to be estimated.

Resource use efficiency

MVP = MPP*py

MFC = pxi

Where

P_{xi} = price of the i^{th} variable input

MPP = marginal physical production that is dy/dx_i

U_i = error term

The ratios of the MVP to MFC were used to determine the efficiency of resources used in irrigated tomato production.

The ratio used thus:

$r_i = 1$ (MVP = MFC), resource being efficiently utilized

$r_i < 1$ (MVP < MFC), resources being over utilized

$r_i > 1$ (MVP > MFC), resources being under utilized

a firm is to maximize profit when the ratio of the MVP to MFC is unity

III. RESULTS AND DISCUSSION

Stochastic Frontier Analysis

Result in the Table 1 showed the maximum likelihood estimates (MLE) of the parameters of the stochastic model of irrigated tomato production in the study area. The variance parameters are represented by sigma square (δ^2) and gamma (γ). The sigma square showed a good fit and correctness of the distributional form assumed for the composite error term. The estimated gamma is 0.96, which showed that 96% of the variation in irrigated tomato output was due to difference in technical efficiency. The mean technical efficiency (TE) is 0.89 (89%) which indicated that tomato farmers in the study area are not fully efficient because they operated below the frontier level. The result of the analysis also showed that farm size, fertilizer and insecticides were the major factors that influenced output of the crop and are all statistically significant at 1% level. Technical inefficiency arises from the socio - economic characteristics of farmers. The result further showed that age and education have negative coefficients, which showed decrease in inefficiency with education only being significant at 5% level. This finding is in consonance with the findings of Onu and Edon [13] who reported that age and education decreases inefficiency.

Resource Use Efficiency of irrigated tomato production

Economic efficiency of resources used of irrigated tomato production was obtained using the ratio of the marginal value product (MVP) to the marginal factor cost (MFC). The computed ratios of the MVPs to the MFCs are presented in Table 2. The results indicated that the farm size was under-utilized since the ratio exceeded unity while Fertilizer and insecticide were over utilized because the estimated efficiency ratios differed from unity. This implied that an increase in the use of land would lead to an increase in output of irrigated tomato production in the study area. The result of the study further showed that a decrease in the use of fertilizer and insecticide would increase the level of irrigated tomato production in the study area. This finding is in consonance with the work carried out by Aboki et al [14] on Productivity and Profitability Analysis of Cassava Production in Taraba State and found that land and fertilizer was over utilized by the cassava farmers.

Constraint Faced by Irrigated Tomato Farmers

The constrained faced by irrigated tomato farmers in the study area is presented in Table 3. The most serious problem facing the farmers was pests and diseases which accounted about 16.53% of the respondents. This is in consonance with Mshelia et al [1] who reported pests and diseases as the major (21.29%) constraints militating against vegetable production among farmers on LakeGeriyio in Adamawa State. The white flea was the most serious pest which attacks the tomato and produced sugary exudates that covered the tomato plant leading to death. The fruit worm also bored through the flowers and young fruits which cause malformation of the fruit. Inadequate credit facilities was the second most serious (14.5%) problem affecting irrigated tomato production in the study area. Low tomato price was another problem facing irrigated tomato farmers which accounted about 4.17% of the respondents. Soil degradation was the fourth problem as attested by 13.3% of the respondents.

IV. CONCLUSION

This study examined resource use efficiency of irrigated tomato production in Northern part of Taraba State, Nigeria. The result of the analysis showed that farm size, fertilizer and insecticides were the major factors that influenced cassava output and were statistically significant at 1% level. It was found out that education has a negative coefficient and statistically significant at 5% level, meaning that education brings about decrease in inefficiency. Finding from this study also showed that farm size was under- utilized while fertilizer and insecticide were over- utilized. The result of this finding also showed that the most serious problem facing irrigated tomato farmers in the area were pests /diseasesand inadequate credit facilities which accounted about 16.53% and 14.5% respectively.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

- (i) Extension services, especially of the ADP should try to enlighten farmers to ensure better and more appropriate application of the modern inputs, especially chemicals in the control of pests and diseases.
- (ii) Access to credit by farmers must be guaranteed by the State Government through special programs to enable farmers acquire more productive modern inputs as well as other cost – elements in the production process.

Table 1: Maximum likelihood Estimates (MLE) of the Stochastic Frontier production function for irrigated tomato farmers

Variables	Parameters	Coefficient	t-value
Stochastic frontier	β_0	3.000***	18.38
Constants			
Farm size	β_1	0.12***	4.59
Seed	β_2	0.03 Ns	0.58
Fertilizer	β_3	0.47***	5.46

Hired labour	β_4	0.02 Ns	0.11
Insecticide	β_5	0.24***	2.60
Family labour	β_6	- 0.005 Ns	-0.46
Inefficiency model			
Constants	δ_0	6.75*	-1.87
Gender	δ_1	4.08**	2.04
Age	δ_2	-0.04 Ns	-0.91
Education	δ_3	-1.73**	-2.001
Farming experience	δ_4	0.46 Ns	1.27
Family size	δ_5	0.24	1.46
Variance parameters	δ^2	0.28*	1.78
Sigma square			
Gamma	Γ	0.96***	36.14
Mean technical efficiency		0.89	

Source: Computer Print out

*Significant at 10%, **Significant at 5% level, *** significant at 1%, Ns = Not significant

Table 2: Estimated resource use efficiency in irrigated tomato production

Resource	MPP	MVP	MFC	r = MVP/MFC
Farm size	4.46	248.34	198.20	1.25
Fertilizer	0.98	12.30	15.65	0.79
Insecticide	21.06	3020.2	4505.90	0.67

Source: Field survey, 2008

Table: 3 Constraints of Irrigated Tomato Production

Constraints	Frequency	Percentage
Pest and diseases	98	16.53
Inadequate credit facilities	86	14.50
Low tomato price	84	14.17
Soil degradation	78	13.15
Inadequate research and extension support	76	12.82
Inaccessibility to cheap farm inputs	63	10.62
Inadequate farm machineries	56	9.44
Lack of good storage facilities	52	8.77
Total	593	100

Source: Field Data, 2007

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