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PRODUCTION EFFICIENCY IN SMALL-SCALE IRRIGATED TOMATO PRODUCTION IN BADE LOCAL GOVERNMENT AREA OF YOBE STATE - NIGERIA.

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ABSTRACT

The study examined Production efficiency in small-scale irrigated tomato production in Bade Local Government Area of Yobe State, Nigeria. Data were collected using multi-stage random sampling procedure. The analytical tools employed include descriptive statistics, gross margin, and multiple regression analyses. The findings of the study revealed that majority of the farmers had 6-10 years of experience in tomato production and earn an average of ₦55, 000 as revenue per annum. Result of multiple regression analysis indicated that fertilizer and labour were significant at 1 % level. The efficiency of resource use in tomato production in the study area indicated under-utilization of land and fertilizer resources, with 86% and 347% adjustments in resource use. It was recommended that policies should be geared towards improving farm size holdings and acquiring of improved farm inputs, which could be achieved through overhauling of the farm credit system. Cultural ownership practices should also be reformed to enable farmers secure land rights and expand their production enterprise.

KEY WORDS: Production efficiency, Tomato, Yobe State, Nigeria

INTRODUCTION

Dry season farming using irrigation is one of the strategies adopted by farmers in the arid zone of Nigeria to diversify agricultural production, raise farm income, and stabilise farm family income. Vegetables are any plant that do not belong to the group of fruits and cereal and are consumed fresh, raw, or processed directly without substantial extraction (Oomen and Grubben, 1978). A fresh vegetable is an essential component of human diet; it contains a number of nutritionally important components such as vitamins, which cannot be synthesized by the human body. Vitamin C is one of such substance.

Tomato is one of the most important vegetables that is consumed by almost all households in northern Nigeria, and in fact throughout the country. It is consumed fresh, in stew, salad and other soups and in the form of tomato ketchup and tomato puree. Owing to its importance, the demand for good quality tomato is high and the returns to growers are substantial (Kabura and Odo, 1995). In spite of its great importance it is locally produced with less investment but under intensive labour and management practice (Tindall, 1992). Production in Nigeria is dominated by small-scale farmers who are resource poor and use rudimentary tools in their production activities, as a result labour intensive management is the production technique adopted by majority of the farmers. Nwaru (2001) also observed that, the problem of acute shortage of rural resource and complexity of modern technologies, have grossly contributed to inefficiency in resource use. Thus, this paper is designed to determine weather small-scale tomato farmers are efficient in their allocation of farm resources.

LITERATURE

The rate of return of resources in agriculture represents earnings per unit of resource (land, labour, capital, and management) rather than total earnings; measure of relative efficiency of resource use, can be used to determine whether farmers are under-paid or not (Rusell and Young, 1983). Technical efficiency relates to the degree to which a farmer produces the maximum feasible output from a given bundle of input (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level of output, an input oriented measure (Rahman, 2003). Allocative efficiency, on the other hand, relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices (Coelli, *et al.*, 2002).

Inefficiency in farming can be reduced significantly by improving rural infrastructure and strengthening extension services. Little effort has been made to improve the technical efficiency of tomato cultivation or to intensify agricultural practice in the way of improved fertility management. This is because manual cultivation of vegetable requires hard labour and thus, restricts the area of cultivation and limits expansion of farm size in some areas (Ibrahim, *et al.*, 2005). Constraints in agricultural production arise from the status of factors of production or poor resource use in land labour, and capital (Anadozie and Nwaru, 2005) In fact, (Nwaru, 2001) asserts that, the problem of acute shortage of rural resource has been complicated by gross inefficiency in resource use. Aihoasu (2002) in a comparative study of up-land and swamp rice production in Ogun state asserts that land is the greatest contributor of variations and efficiency of input use in production of rice.

METHODOLOGY

Study Area

Bade Local Government is situated in the North-western part of Yobe State, Nigeria. It lies between latitude 11^0 4'N and 12^0 80'E longitude 10^0 16'N and 11^0 14'E area. It covers a land area of 5,004 square kilometers. The area has a population of 183,753 people in 1991, the ethnic composition includes Bade, Kanuri, Hausa and Fulani (Census 1991). Most of the people in the area are involved in vegetable farming especially tomato farming

Data collection and sampling

The study utilized both primary and secondary sources of data. The primary data are from farmer's 2004/2005 farming activities.

Three villages known for tomato production purposively selected These are Tagali, Gwio-kura and Yim In each village, 20 farmers were randomly selected making a total of 60 respondents for the study

Analytical technique

The analytical techniques employed for the study include descriptive statistics, gross margin analysis, and

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multiple regression. Descriptive statistics was used to examine the socio-economic characteristics of respondents and the problems associated with tomato production.

Multiple regression technique was used to estimate the physical relationship between the inputs and output and resources use efficiency of tomato farmers.

The implicit form of the model was as follows:-

$Y = f(X_1, X_2 \ldots\ldots\ldots X_n, e)$ ..... (1)

Y - Output (N/basket)
X_1 - Land (ha)
X_2 - Seed (kg)
X_3 - Agro-chemical (lit)
X_4 - Fertilizer (kg)
X_5 - Labour (Man day)
e - Error term

The relative production efficiency model is defined as

$$r = \frac{MVP}{MFC} \ldots\ldots (2)$$

Where:
MVP - Marginal Value Product
MFC - Marginal factor Cost
If r = 1 resource is optimally utilized, r > 1 resource is under-utilized; r < 1 resources is over used (Iheanacho, 2000).

Results and Discussions

The data on socio-economic characteristics of tomato farmers analyzed include gender, age, marital status, family size, educational level, farming experience and annual income. The result presented in Table 1 indicates that 76.7% of the respondents were male, while 23.3% were female, indicating male dominance in tomato production in the area.

Table 1: Socio-economic characteristics of tomato farmers

Socio-economic variable	Frequency	Percentage (%)
Gender		
Male	46	76.7
Female	14	23.3
Total	60	100
Age		
≤ 30	10	16.7
31-40	14	23.3
41-55	32	53.0
56>	04	10.0
Total	60	100
Family size (No)		
1-5	2	3.3
6-10	10	16.6
11-15	20	33.3
16 and above	28	46.7
Total	60	100
Farm size (Ha)	10	16.7
0.1 – 0.5	46	76.7
0.6 -1.0	2	3.3
1.1 – 1.5	1	1.6
1.6 – 2.0	1	1.6
2.1 – 2.5	60	100
Total		
Educational level	30	50
Non-literate	17	28.3
Quranic	3	5.0
Primary	4	6.6
Secondary	6	10.0
Tertiary	60	100
Total		
Farming experience (years)	4	6.6
≤ 5	37	61.7
6-10	9	15 0
11-15	6	10.0
16-20	4	6 6
21≥	60	100
Total		
Annual Income	2	3 3
≤ 10 000	46	76.7
51, 000-100, 000	10	16.6
101, 000-150, 000	2	3.3
200 000≥	60	100
Total		

Field survey, 2005

From the table it could further be seen that, 16.6% of the farmers are aged 30 years and below, 23.3% were in the age bracket of 31- 40 years, while 53% were within the age of 41- 55 years and 56years and above represents 10%. This implies that tomato farmers are in their middle age and majority belongs to this bracket. Family size influences the level of participation in Tomato production, because the larger the family size, the higher the supply of the much-needed farm labour. The study revealed that 46.7% of the respondents had family sizes of greater than 16 persons. Only 3.3% had family sizes of between 1-5 persons

Most small-scale farmers are not using modern

irrigation facilities and equipment because of their small farm sizes. The study revealed that nearly all the farmers (93 4%) had small farm sizes of between 0 1 – 1.0 hectare. This could be attributed to the labour intensive nature of tomato production and the absence of modern technology to support large scale farming. Similarly, Abdullahi (2000) attributed smaller farm sizes for vegetable production among northern Nigerian farmers to limited availability of irrigation water, productive land, and low capital to establish large-scale production. The study revealed that 50% of the farmers were illiterate, 28% had Qur'anic education while 5% had primary education. Only 6.6% and 10% had secondary and tertiary education respectively. The higher level of illiteracy among the farmers (50%) could be a great threat to the development and adoption of improved agricultural practice in the area (Ibrahim et al., 2005). Analysis of farming experience revealed that 6.6% had between 1-5 years experience. Majority (61.7%) had 8 years experience while 15% had farming experiences of between 11-15 years 10% and 6 6% had 16-20 and 21-25 years of farming experience respectively This is an indication that majority of the respondents had farming experience of 6-10 years. Higher farming experience among farmers could lead to improvement in the adoption of appropriate agricultural technology, which is of advantage to the production of tomato (Oomen and Grubben, 1978). With regards to income, the annual income of the farmers in the study revealed that majority earned ₦51, 000 – ₦ 100, 000 per annum representing 76.7% of the farmers while 3.3% and 16% indicated an earning of between ₦ 10, 000 – ₦ 50, 000 and ₦ 101, 000 – ₦ 150, 000 respectively An earning of ₦ 200, 000 and above per annum was indicated by 3.3% of the farmers Annual income of the farmer determines their ability to purchase inputs such as fertilizer, labour, and adoption of improved technology, which could bring about increase in productivity. The higher the annual income of the farmer, the more likely he could increase vegetable production (Abdullahi, 2000).

Cost and Returns in Tomato Production

Table 2: Estimate of cost and return per acre of tomato production

Item	Value (N)	% of total value
Revenue		
Average sales	26672.5	100
Variable cost		
Seed	475	02.81
Fertilizer	2,125	12.56
Labour	11 172.5	66.02
Chemical (Agro)	3,150	18.61
Total variable cost (TVC)	16,922.5	100
Gross Margin (GM)	**9,450**	

Source: Field survey 2005

Table 2, presents the estimates of costs, return, and gross margin per acre associated with tomato production in the study area. The study reveals that average revenue of ₦ 26672 50k per acre is obtained from the sales of tomato. The total variable cost is estimated was to be ₦ 16, 922.50k per acre. with cost of labour accounting for 66 02% of the total Variable Cost. The estimated gross margin per acre is ₦9, 450. The gross margin was used as a proxy for profitability especially in subsistence agriculture where fixed cost of production is negligible as is in the case with small scale tomato production

Production Function Analysis

This explains the physical relationship between input and output and helps in estimation of marginal value product (MVP) of input and their efficiency in production process The multiple regression estimates of the production function are presented in Table 3. Different functional forms were tried, and the double-log was chosen as the lead equation based on the superior quality of this form (econometric and statistical criteria that is t-test, F-test, R^2 and the a priori expectation of the signs and magnitudes of the coefficients)

Table 3: Double-Log Regression Estimate of Function

Variable	Coefficient	Standard error	t-ratio
Land (X_1)	0.124	0.053	2.331**
Seed (X_2)	0.055	0 056	0.987
Fertilizer (X_3)	0 149	0 038	3.955***
Agro-chemical (X_4)	0 026	0 032	0.82
Labour (X_5)	0 151	0.060	2 517***
Constant	2 641	0 103	25.7***
R^2	0.786		
Adjusted R^2	0 754		
F-ratio	34.6		

Source Field survey 2005
*** Significant at 1%
** Significant at 5%

The result indicted that the coefficient of fertilizer and labour were significant at 1% while that of land was significant at 5 and positively related to output of tomato. Since the double-log function was chosen as the lead equation, the coefficie its are therefore direct elasticities (Olayide and Heady, 1982). Thus a unit increase in land, fertilizer, and labour is associated with 0.124, 0.149 and 0.151 increase in output per hectare respectively. Among the significant variables, labour recorded the highest elasticity, followed by fertilizer and then land. This means that tomato output respond more to unit change in labour as compared to a unit change in fertilizer, while fertilizer response is higher than a unit change in land area cultivated.

The coefficient of determination is 0.78; this meaning that 78% of the variation in tomato output has been accounted for by the explanatory variables (various inputs) considered in the model.

Economic efficiency in resource use

The estimate of the Marginal Physical Product (MPP) and Marginal Value Production (MVP) are presented in Table 4 below.

Table 4: Economic efficiency of resource use

Variable	MFC	MVP	Efficiency Score
Land (X_1)	100	186	1.86
Seed (X_2)	150	82.5	0.55
Fertilizer (X_3)	50	223.5	4.47
Agro-chemical (X_4)	100	39	0.39
Labour (X_5)	350	22.65	0.647

Source: Field survey 2005

Based on the values of the marginal physical product (MPP) and the marginal value product (MVP), if other factors are kept constant a unit increase in seed chemical and labour will increase revenue by ₦ 82.50k,—₦ 39.00k, and—₦ 22.65k respectively. The ratios of Marginal Value product (MVP) and Marginal Factor Cost (MFC) were greater than one, for land and fertilizer meaning that these resources are being under-utilized in tomato production in the study area. There is therefore the need for adjustment in marginal value products of these resources for optimal resource allocation. Optimal resource allocation requires that marginal value product be equal to marginal factor cost. Adjustments in marginal value product (MVP) for optional resource allocation of variable input is as presented in table 5.

Table 5: Adjustment in MVP for optimal resource allocation of variable inputs.

Variable	Percentage Adjustment (%)
Land	+86
Seed	-45
Fertilizer	+347
Agro-chemical	-61
Labour	-35

Source: Field survey 2005

Analysis of ratios indicated that land and fertilizer resources were under-utilized; to obtain optimal allocation of land and fertilizer, 86% and 347% increase in land and fertilizer use are necessary, while seed, agro-chemical, and labour require a reduction of 45%, 61%, and 35.3% in input use respectively.

PROBLEMS OF TOMATO PRODUCTION

Production processes are never without problems. However, agricultural production and particularly small-scale agriculture in developing countries especially Nigeria tend to have many problems. These problems are related to socio-economic, institutional, and environmental factors. This study identified certain problems associated with tomato production in the study area and asked farmers to rank in order of magnitude. The results are presented in Table 6 below.

Table 6: Problems faced by tomato producers in Bade Local Government Area.

Problem	Frequency	Percentage (%)	Rank order
Lack of finance	20	33.3	1
High cost of input(s)	13	21.7	2
Pest(s) and disease(s)	9	15	3
Soil fertility	5	8.3	4
Transportation	10	16.7	5
Others	3	5	6
Total	60	100	-

Source: Field survey 2005

The result shows that lack of finance and high cost of inputs were ranked as the first and the second most important problems. Others include pest and disease, soil infertility, transportation, lack of marketing facilities. Lack of finance was therefore a major problem in the study area, which constituted 33.3%. High cost of input is ranked the second important most problems of farmers, and could not be unrelated to the finance problem. This is because tomato production is input-intensive, particularly, labour input, and therefore requires capital for its production as compared to arable enterprises such as millet, maize, and sorghum. Pests and diseases also constitute a problem to tomato farmers in the study area. The result revealed that 15% of the respondents ranked pest and disease as the third most important problem, while soil fertility was ranked fourth, followed by transportation (16.7%) and market facilities (5%). Lack of access to good road network and marketing facilities could lead to spoilage. Similarly, Kabura and Odo (1995), Douli and Buahim (1994) identified shortage of irrigation water, pests and diseases and soil fertility (among others) as important problems affecting vegetable production

in the Fadama areas of Northern Nigeria. Eliminating some of these major problems will therefore go a long way in improving tomato production in the study area.

CONCLUSION AND RECOMMENDATION

Tomato production in the study area is profitable with a gross margin of ₦ 9,450 per acre. The study however reveals the under-utilization of some important inputs, particularly fertilizer and land with resource adjustment of 347% and 86%.

Following the results, it was recommended that policies should be geared toward improving farm size holdings and acquisition of improved farm inputs, which could be achieved through overhauling of the farm credit system. Cultural ownership practices of land acquisition should also be reformed to enable farmers secure land rights, to expand their farm enterprise.

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