Journal of Horticulture and Forestry Vol. 3(12), pp. 372-378, 15 November, 2011
Available online http://www.academicjournals.org/jhf
ISSN 2006-9782 © 2011 Academic Journals

Full Length Research Paper

Production efficiency of yam in Zing Local Government Area of Taraba State, Nigeria

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Accepted 2 June, 2011

The research was carried out to analyze the efficiency of yam production in Zing Local Government Area of Taraba State. Data were collected from 103 respondents using multistage sampling techniques, and analyzed by means of descriptive statistics, multiple regression and profitability analysis. Findings indicated that 95% of the respondents were males, 38.8% fall within 31 to 40years of age. 84.4% were married and about 72.8% have one formal educational level or the other. 53.4% operate only 1 to 2 hectares of farm land. The double log function with R^2 of 0.745 was the best fit. The study established that farm size, yam seed and fertilizer were positively related to yam output and significant at 1 and 5% levels respectively. The marginal analysis of input utilization revealed that farm size, yam seed and labour (family and hired) were rationally used but not at optimal levels. Therefore, more than 97, 66.55 and 36% increase in MVP respectively were required. Average gross income was found to be N241,800.00 with average total cost of N125,320.00 per hectare. Yam seed constituted the greatest share of the total cost representing 66.8% with an average cost of N85 per kg. Operating ration of 0.43 indicates moderate total revenue over total variable cost. RRI was 92.9% and profitability index of 48.2%. Issuing of micro soft loan at bearable interest rate, technical research and the provision of improved practices was therefore recommended.

Key word: Zing, economic analysis, yam, production, efficiency.

INTRODUCTION

Yam is an annual tuber and monocot plant. It belongs to the genus “Dioscorea” and the family “dioscoreacea”. The food plant comprises of 600 species out of which ten species produces edible tubers and only six are cultivated in Africa. The current estimate of world yam production is far from reliable. The latest FAO statistics of 1989 to 1990 still do not include Asia, India, China or Indonesia. Moreover, the structure of production system that includes yams clearly creates an obstacle to making estimate. In this regard, yam production is under estimated, but it is not known by how much. Yam production trend is to be at least around 25 million tons in 1992; it is thus the fourth major root crop in the world after potatoes, cassava and sweet potatoes (Degras,1993; Asiedu, 1999). Yam productions continue to increase from 6% in Central America to 15% in Asia and yield raises to 20% (National Root Crop Research Institute, 2004). Amegbeto and Asiedu (2000) reported that the international trade of yam originates from Jamaica as the leading exporter in Central America, Brazil lead in South America while Japan leads the production in Asia. Asomugha and Ujoku (2007) stressed that West and Central Africa accounts for about 93% of the world total production (38 million tons). The dominant yam production zones stretches from Coted’ivoire through Ghana, Togo, Benin, Nigeria, Cameroon, Gabon, Central African Republic and the Western part of the democratic Republic of Congo. Ethiopia and Sudan are major yam producers in East Africa. IITA (1991, 1993) reported that Nigeria remains the principal yam producer

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with the world production percentage of 71.9% in recent years. Coted'ivore, the second largest producer had production percentage increase from 9.3 to 10.6% with its yield increase by 7.6% with approximately the same percentage of cultivated surface area of 10.4%. Ghana, the third largest yam producer increase its production almost by 20% (Asumugha and Njoku, 2007). Yam production in Nigeria is quite high.

The annual production in the country is estimated at 26.59 million metric tons (FAO, 2006). The annual growth rate for the same period was 6% for the yield and 10% for the area planted. With growing demand, yam has assumed great importance in Nigeria. The nation produces about 31.5 million metric tons of yam annually. CBN (2003) and FAO (2002) reported that Nigeria accounts for 71% (26 million tons) of the total world production of yam harvested from 2,760.00 hectares. On the basis of quality of root and tuber crops produced in Nigeria, yam ranks second only after cassava (NBS, 2007). The edible varieties of yam are important food crop and serve as an important carbohydrate staple for millions of people in both the tropical and sub-tropical countries in West Africa, Caribbean, the Northern and central part of South-East Asia including some part of China, Malaysia, Japan and Oceania (Adetuyi et al., 2010). In Nigeria, yam is becoming more expensive and relatively unaffordable in urban areas as production growth has not kept pace with population growth leading to demand exceeding supply (Kushwaha and Polycarp, 2000). Production of yam in Nigeria is believed to be constrained mostly by high cost of seed. It is observed that the defect of traditional farming of the people of Zing, in Taraba State has tremendously undermined the high production trend of yam in the area. However, not all farmers' can allocate resources efficiently for yam production in the study area. The specific objectives of this study were to:

i) Describe the socio-economic characteristics of yam producers;
ii) Estimate the efficient use of yam production resources, and;
iii) Determine the profitability status of yam production.

METHODOLOGY

Study area

Zing Local Government Area is one of the 16 LGAs in Taraba State. It is bounded by Yorro LGA in the south, in the North-East and West respectively by Adamawa State. The area lies between longitude 10° and 11°E and latitude 9° and 10°N of the equator with estimated population of about 115,384 (NPC, 2006). The area falls within the transitional belt of savanna in north eastern Nigeria. It has good climatic conditions and rich in agricultural opportunities with the temperature ranging from 28 to 34°C, the mean annual rainfall of the area is 1500 mm. The study area is endowed with abundant natural resources including, streams, natural grassland and economic trees.

Data collection and sampling techniques

Primary data was employed for this study. The primary data were obtained through the use of structured questionnaires which were administered by trained enumerators under the supervision of the researchers. Information on yam farmers' socio-economic characteristics, production activities and cost and return on yam production were among the bulk of data collected. Yam farmers were the population from which samples were drawn. From the list of the districts, political wards, villages and yam farmers, a sampling frame of 520 yam farmers were obtained for the study. Accordingly, purposive and multistage random sampling techniques were employed to draw respondents namely: The first stage was the selection of 10 political wards in the local government area. The selection of 30% of the villages (66) in each of the council wards to give a total of 20 villages was the second stage. Finally, the third stage was the drawing of 25% of the farmers in each of the selected villages to give a total sample size of 130 respondents. In each of the stages, random sampling technique (Lottery method) was employed to draw the sample units.

Method of data analysis

Simple descriptive statistic, multiple regression and profitability (gross margin) analysis were used to analyze the data obtained for the research objectives. The descriptive statistic involved the use of frequencies, and percentages to describe the socio-economic characteristics of the yam farmers. Multiple regression analysis was employed to examine the efficient utilization of variable inputs on the output of the local yam farmers in the study area. The general form of the equation is stated as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, U_i) \quad (1)$$

Where:

Y = Output of yam (kg)
X_1 = Farm size (ha)
X_2 = Quantity of yam seed in numbers (100 tubers)
X_3 = Family labour in man days
X_4 = Hired labour in man-days
X_5 = Quantity of fertilizer used (kg)
X_6 = Farming experience (years)
U_i = Error term

Four different functional forms (linear, exponential, semi-log and double log) were employed for the analysis, out of which the double log function was chosen as the best fit. The selection of double log function as the lead equation was based on the magnitudes and appropriateness of signs of the estimated regression coefficients, standard errors of estimates, magnitudes of the coefficient of multiple determination (R^2) significance of the estimated coefficients and F- value. The model is stated as follows:

$$\text{Log } Y = ß_0 + ß_1 \log X_1 + ß_2 \log X_2 + ß_3 \log X_3 + ß_4 \log X_4 + ß_5 \log X_5 + ß_6 \log X_6 + Ui$$

Where,

Log = Natural logarithm
Y, X_1 ---- X_6 are as defined in Equation 1
B_1 ----- B_6 are parameters to be estimated
B_0 = Constant term
Ui = Error term.

Marginal analysis of input utilization was used to determine the

Table 1. Distribution of respondents by socio-economic characteristics (n = 103).

Variable	Frequency	Percentage
Gender		
Male	98	95.0
Female	05	5.0
Age (year)		
21- 30	32	31.1
31 – 40	40	38.8
41 – 50	23	22.3
51 – Above	08	7.8
Marital status		
Married	87	84.4
Single	12	11.7
Widowed	03	2.9
Divorced	01	1.0
Educational attainment		
Non-formal education	28	27.2
Primary education	23	22.3
Secondary education	29	28.2
Tertiary education	23	22.3
Farming experience (years)		
1 - 10	20	19.4
11 - 20	50	48.5
21 - 30	19	18.5
31 - Above	14	13.6
Farm size (hectares)		
Less than 1	07	6.8
1 - 2	55	53.4
Above 2	41	39.8

Source: Field survey (2010).

resource use efficiency of the inputs used by the farmers. The values of marginal product were estimated using the regression coefficient of each input and the arithematic mean value of farm output and inputs. Fallowing Shehu et al. (2006), the MVP of each resource was measured. The acquisition cost of each resource was used as the marginal factor cost (MFC). This was based on the assumption that farmers operate in a pure competitive input markets (Olukosi and Ogungbile, 1989). The MVP was compared with MFC of the inputs to determine the efficiency of use of the inputs. The decision rule used to ascertain whether an input is over, under or optimally utilized was interpreted as described by Iheanacho et al. (2000) that when the efficiency unit (r) is unity, it indicates resource use optimization, negative unit means over utilization of resources while positive unit suggest under utilization of resources. The gross margin is the difference between gross farm income and the total variable cost of production. It was used to estimate the profitability level of yam production in the area.

Gross margin (profitability) analysis is used to evaluate the efficiency of an individual business (Olukosi and Erhabor, 1998; Idowu, 2009) while the net farm income is the difference between the gross margin and the total cost of production less the sum of fixed variable cost. The gross margin model states as follows:

$$GM = GI - TVC \quad (2)$$
$$NFI = GM - TFC \quad (3)$$

Where,

GM = Gross margin per hectare (N)
GI = Gross income per hectare (N)
TVC = Total variable cost per hectare (N)
NFI = Net farm income per hectare (N)
TFC = Total fixed cost per hectare (N)

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

The summary of the results on social economic

Table 2. Double-log regression estimates for yam production.

Variable	Coefficient	Std. error	T- value
Farm size (X_1)	0.091	0.072	15.184 ***
Yam seed (X_2)	0.118	0.065	1.820**
Family labour (X_3)	0.011	0.035	0.321NS
Hired labour (X_4)	-0.025	0.032	-0.793NS
Fertilizer (X_5)	0.035	0.013	2.827 ***
Farming exp. (X_6)	-0.073	0.067	-1.077 NS
R^2		0.745	0.164
F-value	46.674***	--	--
Constant	3.499***	--	--

Source: Survey data (2010); *** Significant at 1%; ** Significant at 5%; NS (not significant).

Table 3. Marginal analysis of input used by yam farmers.

Variable	MPP	MVP	MFC	MVP/MFC
Farm size (X_1)	8766.31	745,136.35	15,675	4.07
Yam seed (X_2)	0.9624	81.0884	27.077	2.9
Family labour (X_3)	0.6997	59.475	38.211	1.56
Hired labour (X_4)	5.8100	-493.85	191.200	-2.58
Fertilizer (X_5)	5.6177	477.504	475.4	1.00

Source: Survey data (2010).

characteristics are presented in Table 1. This indicated that 95% were males, while only 5% were females. This means that men do most of the yam production activities than women probably do due to their ownership of farmland. This result is also supported by Ani (2004). Age brackets of the respondents in the area shows that 38.8% were within the ages of 31 to 40 years as reported by Fadeji (2006) that the average age of 49% of the respondents falls between 31 to 40 years. This is most obvious as more strenuous yam operations such as heap making are mostly done by young men that are active and energetic. The educational status of the respondents indicated that 28.2% attended secondary school, 22.3% attended tertiary educational level and 27.2% had no formal education. Majority of the respondents representing 60.2% had farm size of less than or equal to 2 hectares, only about 39.8% had above 2 hectares with farming experience between 11 to 20 years. This therefore, reveals that the yam farmers in the study area are really small scale farmers. Ibrahim (2004) observed that small scale farmers are those that cultivate farm land not more than 2 hectares.

Resources use relationship in yam production

The results of the regression analysis as reflected in Table 2 revealed that the coefficient of multiple determination (R^2) was 0.745. This indicates that about 75% of the variation in output is accounted for by the variations in the independent variables used for the production. The remaining 25% may be attributed to variations in other factors not included in the model. Farm size, yam seed and fertilizer were significant and have positive relationship with the output. This result agreed with that of Sulumbe et al. (2010), who established that age, family size, income and extension contact were positively related to output and significant at 1% level. The coefficients of farm size (X_1) and fertilizer (X_5) were positive and significant at 1% level. This means that a unit increase in these variables, under static condition of other explanatory variables result in increased output level. This result is in conformity with Shehu et al. (2009) that increase in farm size implies more output is expected. The coefficient of yam seed (X_2) was also positive but significant at 5% level. Also, the coefficient of family labour (X_3) was positive but not statistically significant.

Marginal analysis of resource efficiency utilization

The result shows that increase in one hectare of farm size would result in 8,766.31 (Table 3). This implies that increase in farm size by one hectare would result to extra 8766 kg of yam. Also, an extra use of 1 kg of yam seed would give an additional 0.9624 kg of yam and extra use of one man day of family labour would give extras of0.6997 kg of yam. Increase in fertilizer usage by 1 kg

Table 4. Absolute value of the required adjustment in MVPS (in percentage) for optimal allocation of variable input.

Variable	Adjustment required
Farm size (X_1)	97.43
Yam seed (X_2)	66.55
Family labour (X_3)	35.90
Hired labour (X_4)	61.24
Fertilizer (X_5)	100.00

Source: Survey data (2010).

Table 5. Average costs and returns of yam production.

Variable	Unit	Unit cost (N)	Quantity	Value (N)	Percentage (%)
Yam output (YO)	Kg	120	2,015	241,800	
Variable costs (VC)					
Yam seed	Kg	85	985	83,725	66.8
Labour	Man-days	125	34	4,250	3.4
Fertilizer	Kg	70	84.2	5,894	4.7
Transportation	Kg	5	1545	7,725	6.2
Storage	Kg	2	778	1, 556	1.2
Total variable cost (TVC)	-	-	-	103,150	
Fixed costs (FC)					
Land lease	Ha	8300	2.4	19,920	15.9
Utilities	-	-	-	2,250	1.8
Total fixed cost (TFC)	-	-	-	22,170	
Total cost (TC)				125,320	
Gross margin	-	-	-	138,650	
Net farm income	-	-	-	116,480	

Source: Field data (2010).

would increase output of yam by 5.6177 kg. Economic theory states that a firm maximizes profit with respect to an input if the ratio of its MVP to its MFC is unity (Kay, 1986). Comparison of the MVP to MFC ratios shows resources such as farm size and yam seed are greatly more than unity. This implies that they are largely underutilized while family labour is slightly underutilized. Fertilizer ratio is exactly unity (1) suggesting that it was efficiently utilized. Hired labour ratio was negative signifying that it was over utilized during the growing period of yam production.

Optimum resource allocation adjustment requirement for mvp_s

The required adjustment allocation for optimum resources in yam production in the study area is hereby presented in Table 4. The results indicate that for optimal allocation of farm size, more than 97% increase in MVPS was required. Also, more than 66.55 and 40% increase in MVPS were required for yam seed and family labour respectively. For hired labour about 61.24% resource application need be reduced to obtain the optimum requirement.

Average costs and returns of yam production

The result of the average costs and returns per hectare is hereby presented in Table 5. The average gross income that accrued from the sales of yam at the average cost of N120 per tuber (1 kg equivalent) was found to be N241,800.00. The average total cost was N125,320.00. Yam seed constituted the greatest share of the total cost representing 66.8% with an average cost of N85 per kg followed by land lease with 15.9% which has the average rentage cost of N8,300/ha. This study agreed with Abubakar et al. (2005) that yam seed accounted for the greater portion (60.00%) of the total variable cost. This

Table 6. Profitability ratio analysis of yam production.

Parameter	Value	Percentage
Profitability index (PI)	0.482	48.2
Rate of return on investment (RRI)	0.929	92.9
Rate of returns on variable cost (RRVC)	2.129	212.9
Operating ration (OR)	0.426	42.6

Source: Field data (2010).

could be attributed to the scarcity of yam tubers as well as seed yam during planting period. The total variable cost constituted 82.3% (N103,150.00) of the total cost while the total fixed cost was 17.7% (N22,1700) of the total cost. The average gross margin and net farm income of the production per hectare were N138,650.00 and N116,480.00 respectively. This can be deduced that yam production in the area is profitable.

Profitability ratios of yam production

The profitability ratio of yam production was computed to establish the profitability level of yam production. Result of Table 6 revealed that the profitability index (return to scale) (PI), rate of returns on investment (RRI), rate of returns on variable cost (RRVC) and operating ratio (OR) were ₦0.482, ₦0.929, ₦2.129 and ₦0.426. PI of 0.482 indicates that for every naira invested, about 48 kobo is returned as net profit to the farmer. Also, the farmer earns about 93 kobo as net income on every naira spent on yam production on the average. The rate of returns on variable cost of ₦2.129 indicates the farmers' returns on every naira expended. Finally, an operating ratio that is less than one indicates a good, efficient and profitable venture. Therefore, the OR of 0.43 indicates moderate total revenue over total variable cost, which is good for the venture.

Conclusion

The result on the socio-economic characteristics indicated that most (95%) of the farmers are males and only 5% are females. 13.8% were between 31 to 40 years of age, signifying that the farmers are in their youthful age. Also, the educational status of the farmers indicated that they had formal education up to secondary school level. Their farming experience was between 11 to 20 years and majority of 53.3% had farm holdings of between 1 to 2 hectares. The result of the regression analysis revealed that farm size and fertilizer were positive and significant at 1% level, while yam seed was also positive and significant at 5% level. This implies that increasing these variable inputs would result in an increased output level of yam. The result of marginal analysis of resource efficiency utilization shows that increase in one hectare of farm size, 1 kg of yam seed, extra use of one man-day of family labour and increase fertilizer usage by 1 kg would result in the corresponding increase in extra 8,766, 0.9624, 0.6997 and 5.6177 kg of yam respectively. Result of the average cost and returns indicated that GI, GM and NFC were ₦241,800.00, ₦138,650.00 and ₦116, 480.00 respectively. It is therefore recommended that the farmers should increase their farm size, yam seed and fertilizer usage. Also, government in their effort in improving yam production should enhance technical research on yam and timely provision of credit facilities to farmers in order to boost their yam production abilities.

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