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Profitability and Determinants of Maximum Variable Profit of Yam Production in Southwest Nigeria

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***Abstract* – This study investigated the profitability and determinants of maximum variable profit of yam production in Southwest Nigeria. Multistage and random sampling techniques were used to select 320 respondents. Data were collected through the administration of structured questionnaire and personal interview. Data were analyzed using descriptive statistics, budgetary technique and profit function regression. Results indicated that yam production in the area was proven profitable by the estimated positive values of gross margin (₦308,744,801), net farm income (₦277,888,701), mean net farm income (₦868,402.19) and net return on investment (0.97). Per unit prices of output, seed yam and labour significantly determined maximum variable profit while per unit price of fertilizer, farmer's age, education, farming experience, household size and extension visit were not significant. Adopting the principles of cost minimization such as bulk purchase of inputs and value addition as in product storage would reduce cost of production and enhance profit.**

***Keywords* – Profitability, Yam Production, Profit Function Regression, Southwest Nigeria.**

I. INTRODUCTION

Yam (*Disocorea spp*) belongs to the class of crops called roots and tubers based on their uses, and it is a major tuber staple in west and central Africa where it provides food for over 160 million people [1]. Yam is an important carbohydrate-based crop in Nigeria, although its importance in the diets of the various tribes in the country differs. Traditionally, the tuber can be cooked, fried or roasted. Alternatively, it can be processed into pounded yam, yam flour, yam chips or porridge [1]. Yam is also presented in traditional and marriage ceremonies. Medicinally, the mucilaginous tuber milk contains allantoid, a cell proliferate that speed up the healing process when applied externally to ulcers, boils and abscesses. Its decoction is also used to stimulate appetite and to relieve irritation and cough [2]. Yams are more nutritious than cassava or sweet potato and highly prized for its taste and source of protein, fat and vitamin than cassava [1].

Although Nigeria is currently the world's largest producer of yam with total production output estimate of 37.1 million tonnes accounting for about 67% of world production. [3].The price of yam has continued to increase due to rising demand contrary to lagging supply. This development could be attributed to high rate of population growth and production problems such as inadequate credit facilities, scarcity and high cost of inputs, diseases and pests attacks among others [4]. These production problems result in production inefficiency, low productivity and profitability. Based on this backdrop, the study examined the profitability and determinants of maximum variable profit of yam production in Southwest Nigeria with the view to providing working information for policy makers, research institutions, intending and existing yam farmers and private interests.

II. MATERIALS AND METHODS

The study was conducted in Southwest Nigeria consisting of Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States. The area lies between longitude 2^0 31' and 6^0 00' East and latitude 6^0 21^0 and 8^0 37' North of equator [5], with a total area of 77, 818 Km^2 and projected population of 27,340,254 people [6]. The area represents two ecological zones - forest regrowth and southern guinea savannah ecological zones. The mean annual temperature ranges from 21.1^0C to 31.1^0C and the annual rainfall ranges of 800mm to 1500mm in the rainforest belt.

Multistage, purposive and random sampling methods were used to select 320 respondents for the study. In the first stage, two States (Ekiti and Osun) were purposively selected from the six states in the area. The selection was based on the preponderance of upland and wetland yam farmers evidenced from pre-survey study. Stage II involved random selection of two LGAs each from the two agricultural zones in Osun State and two LGAs from the two agricultural zones in Ekiti State to arrive at four LGAs. At stage III, two communities were randomly selected from each of the four selected LGAs to arrive at eight communities. Finally, simple random method was used to select twenty (ie ten each of upland and wetland) yam farmers from each of the eight selected communities to arrive at 320 respondents at stage IV.

Data for the study were collected from primary sources using well structured and pre-tested questionnaire and personal interview schedule. Data were collected on socio-economic characteristics of the farmers, production variables and current market prices. Collected data were analyzed using descriptive statistics, enterprise budgeting and profit function regression.

The budgetary method was used to determine enterprise profitability and is given as:
GM = TR-TVC
NFI = GM-TFC or TR-TC
MNFI = NFI/N
ROI = TR/TC
NROI = NFI/TC

Where:
GM = Gross margin
TR = Total revenue
TVC = Total variable cost
TFC = Total fixed cost
TC = Total cost
NFI = Net farm income/profit
MNFI = Mean net farm income
N = Number of respondents
ROI = Return on investment
NROI = Net return on investment.

The profit function regression was used to estimate the effects of per unit prices of output and inputs, and the farmers' socio-economic variables on maximum variable profit. The profit function was used because of its importance in diagnostic analysis reflecting marginal resource profitability at mean levels of input price [7]. The profit function model is implicitly specified as: $\Pi^* = \Pi^* \left(Py, P_1, P_2, P_3, Z_1, Z_2, S_1, S_2, S_3, S_4, S_5\right)$

Where:
Π^* = Amount of maximum variable profit (₦)
Py = Per unit price of output (₦)
P_1 = Per unit price of yam seed(₦)
P_2 = Per unit price of fertilizer (₦)
P_3 = Per unit price of labour (₦)
Z_1 = Value of land (₦)
Z_2 = Value of machete, hoe, wheelbarrow/basket (₦)
S_1 = Farmer's age (years)
S_2 = Farmer's educational level (years)
S_3 = Farmer's farming experience (years)
S_4 = Farmer's household size (number)
S_5 = Extension visits (number of visits per farming season)

Note: Z_1 and Z_2 are fixed cost items and were not included in the analysis since the analysis was based on short-run effect of input prices [8].

III. Results and Discussions

Socio-economic statistics of the farmers

Findings on socio-economic characteristics of the farmers (Table 1) indicated that majority (68%) were males, mean age of the farmers was 44years, about 61% were married, average household size was 6 persons, educational attainment was 17 years, farming experience averaged 19 years while mean farm size was 0.7 hectare. The implications of these findings were that most of the farmers were males and in their youthful age and therefore possessed the strength to withstand the rigorous activities involved in yam production so as to earn better profit. Furthermore, the farmers attained one form of formal education or the other and had farmed yam for at least 15 years. This implied that they were educated and experienced. The antecedents noted by [9] and [10] as veritable tools for acquiring new skills and ideas that bear positively on scope of enterprising, income and profit.

Profitability of yam production in the area

The enterprise budgeting analysis was used to determine the profitability of yam production in the area. The analysis indicating total revenue (TR), total cost (TC), total variable cost (TVC), total fixed cost (TFC), gross margin (GM), net farm income (NFI), mean net farm income (MNFI), return on investment (ROI), net return on investment (NROI) and other variables are presented in Table 2. The yam farmers incurred several costs in the course of production. These costs were variable and fixed costs. The variable costs were expenses on seed yams, herbicides, labour, fertilizer, transportation and storage while the fixed costs include depreciation costs of machet, hoe, basket/head pan, bicycle and interest on loan. It could be seen from Table 2 that yam farmers in the area spent ₦297, 831, 964 on variable cost items, representing 96.48% of the total cost of production. Out of this percentage, seed yams accounted for 40.68%, labour 35.62% and the least variable cost item was storage cost (1.40%). In all, a maximum of ₦62,856,926, minimum of ₦861,250 and average of ₦964,650.36 were expended by the farmers within the production season. [4] noted that yam farmers in Ekiti State, Nigeria spent 96.69% of the total cost of production on variable inputs while [1] recorded 64.5% in Oyo State, Nigeria.

Table 1: Socio-economic statistics of the yam farmers

Variable	Mean/Mode
Gender	male (68%)
Age	44 years
Marital status	married (61%)
Household size	6 persons
Educational level	17 years
Farming experience	19 years
Farm size	0.7 hectare

Source: Field survey, 2013.

Table 2: Estimated profitability of yam Production

Variable	Amount (₦)	% of TC
Total revenue	606, 576, 815	
Variable cost:		
Yam seeds	125, 713, 852	40.73
Herbicides	6, 971, 900	2.26
Labour	110,020,828 .20	35.64
Fertilizer	44, 097, 072	14.29
Transportation	5, 983, 000	19.38
Storage	5, 095, 311 .80	16.51
Total variable cost (TVC)	297, 831, 964	96.48

Fixed cost:		
Dep. on machete	2, 550, 370	0.83
Dep. on hoe	2, 475, 420	0.80
Dep. on bicycle/motorcycle	2, 201, 400	0.71
Dep. on basket / head pan	1, 736, 460	0.56
Interest on loan	1, 892, 500	0.61
Total fixed cost (TFC)	10, 856, 150	3.52
Total cost (TC = TVC + TFC)	308, 388, 114	100
Gross margin (GM = TR – TVC)	308, 744, 851	
Net farm income (NFI = TR – TC)	297, 888, 701	
Mean net farm income (MNFI = NFI/n)	1, 861, 804 .39	
Net return on investment (NROI = NFI / TC)	0.97	
Source: Field survey, 2013.	Source: Field survey, 2013.	

Further result of the analysis in Table 2 generated positive gross margin, net farm income, mean net farm income and net return on investment values of ₦308,744,801, ₦277,888,701, ₦861804.39 and 0.97 to prove yam production enterprise profitable in the area. Yam farming has also been adjudged profitable by studies conducted in Edo and Taraba States of Nigeria by Eyitayo *et al.* (2010) and Reuben and Barau (2012) respectively. Net return on investment was 0.97, implying that the farmers returned ₦0.97 for every ₦1.00 invested in the business. The farmers might have engaged better management practices such as bulk purchases of variable inputs and more intensive use of resources in order to achieve better profits.

More so, the profit function was used to estimate the effects of prices of individual resource inputs and output as well as the effects of socio-economic factors on maximum variable profit. The nine independent variables included in the model were per unit price of output (PPO), per unit price of seed yam (PPS), per unit price of fertilizer (PPF), per unit price of labour (PPL); others were the socio-economic factors including age (AGE), educational level (EDU), farming experience (FAE), household size (HOS) and extension visit (EXV). Result of the analysis as shown in Table 3 indicated that three of the variables (per unit prices of output, seed yam and labour) were statistically significant at 5% level while the rest six variables (per unit prices of fertilizer and the socio-economic factors including age, educational level, farming experience, household size and extension visit) were not significant.

Per unit price of output had positive and significant relationship with profit. This is according to *a priori* expectations and meant that high output price would enhance income and profit of yam production. Ugwumba (2011) reported a statistically significant and positive relationship between output price and profit of catfish production in Anambra State. The coefficient of per unit price of seed yams was statistically significant at 5% level ($P \leq 0.05$) and negative. This result is in consonance with *a priori* expectations and implied that high cost of seed yams would increased total cost of production and drastically reduced revenue and hence net farm income (profit) realized by the farmers. The result of cost analysis for this study (Table 2) indicated that cost of seed yams accounted for 40.68% of total cost of yam production and further confirms the above claim.

The coefficient of per unit price of labour was statistically significant at 5% level of probability and negative, implying that higher the cost of labour, higher the cost of production and consequently lower the amount of profit earned by the yam farmers. The coefficients of the rest five variables (per unit price of fertilizer, age, education, farming experience and extension visit) were positive but not statistically significant while that of household sizes was negative and also not significant. The R^2 value of 53.4% indicated that about 53.4% of the variation in maximum variable profit was accounted for by the independent variables and the rest 46.6% was due to random disturbance. The F- statistic and Durbin – Watson statistic values were significant, indicating overall significance of the regression and absence of autocorrelation among observations of the same variable.

Table 3: Estimated determinants of maximum variable profit

Predictor	**Coefficient**	**StDev**	**T**	**P**
Constant	1.4392	0.3342	3.41	0.000
PPO	0.2467	0.0593	2.67	0.000**
PPS	- 0.1420	0.0456	- 2.34	0.000**
PPF	0.0127	0.0249	0.87	0.674
PPL	- 1278	0.0541	-2.28	0.012**
AGE	0.1314	0.1432	0.92	0.332
EDU	0.0174	0.0316	0.48	0.574
FAE	0.0133	0.0369	0.31	0.674
HOS	- 0.0014	0.0026	- 0.55	0.583
EXV	0.0043	0.0077	0.07	0.328
R^2	53.4%			
R^2 (Adj.)	50.3%			
F-stat.	19.13			
D-W. stat.	1.78			

Source: Field survey data, 2013. Notes: ** = Significant at 5% probability level. StDev = Standard deviation. T = T-ratio. P = Probability.

IV. CONCLUSION

Yam production in Southwest Nigeria proved to be a profitable enterprise given the positive values of estimated gross margin, net farm income, mean net farm income and net return on investment. Per unit prices of output, seed yam and labour significantly determined maximum variable profit. Adopting the principles of cost minimization such as bulk purchase of inputs and value addition as in product storage would reduce cost of production and enhance profit.

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