SOCIO–ECONOMIC ANALYSIS OF INCOME DETERMINANTS AMONG SMALL–SCALE TOMATO FARMERS USING TIN MINING PONDS IN THE JOS PLATEAU, NIGERIA

M. B. Hassan and S. A. Sanni

[1]Department of Agricultural Economics and Rural Sociology, Institute for Agricultural Research/Ahmadu Bello University, Zaria

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Abstract

This study was carried out in Barkin–Ladi Local Government area of Plateau State where tomato production dominates the irrigated farms. The study focused on the socio–economic characteristics of tomato farmers, the profitability of irrigated tomato production, socio–economic factors determining profitability and the constraints to tomato production. Data were collected using multi–stage sampling technique from 88 tomato farmers in the study area with the aid of structured questionnaires. Data collected were for 2008/2009 farming season. They were analysed using descriptive statistics, farm budget technique and ordinary least square regression technique. The results showed that 78 % of the farmers were males and 22 % were females. 22 % of the farmers had access to credit and 9 % had access to extension. The result also reveals that an average net farm income of ₦129, 994.34 per hectare accrued to tomato farmers. The result shows that the coefficient of determination (R^2) has a value of 0.44. This implies that 44 % of the variation in income of the irrigated tomato farmers was explained by the variables in the model. It also has a high F–value which was significant at 1 % which signifies the rejection of the null hypothesis. Household size, credit amount, years of experience in irrigation farming and access to extension significantly influenced tomato farmers' income. The study concludes that access to credit and well managed household size could improve farmers' income by using more of these resources.

Keywords: Farm income, irrigation, income determinants, Jos Plateau, mining ponds, tomato

INTRODUCTION

All major economies of the world, even the richest, started out as primarily agrarian economies. Over time, economic development has stimulated a process of structural transformation during which broad–based productivity growth accompanied a shifting sectoral composition of economic activity. As a result, many development specialists have come to believe that early investments in agricultural productivity constitute a necessary precondition for overall economic growth. For without rising farm productivity, the transfer of labour and capital from agriculture will lead to falling agricultural output, rising food prices and growing poverty (Johnston & Mellor 1961).

The main goals of a farmer are: (i) to meet his family requirements, both material and non–materials, (ii) to achieve maximum economic return and (iii) to reduce the risk in farming. Farmers continuously judge the cost and benefits of their farming actions against these goals, and decide to change if the net gains in terms of the set goals are profitable. Most economists' believed, however any improvement in the productivity of farmers' resource without increasing the risk will enhance the overall goals set by farmers. Therefore any technology should increase farmers' productivity, reduce the cost of production and/or reduce the risk in farming. Empirical evidence suggests that irrigation projects have positive impacts on agricultural production and the reduction of poverty for farmers (Hussain & Hanjra 2004; Smith 2004; Lipton, 2007a). Access to irrigation provides farmers with a reliable water source at critical times in the crop's life cycle, removing the dependence and inherent uncertainty of rainfed. There are many river basins irrigation projects in Nigeria that were establish to aid the reduction in the risk faced by farmers and likely to increase their mean agricultural production and also to reduce their vulnerability to income fluctuations. While farmers are exposed to unforeseen production shocks regardless of the production systems, irrigation minimizes these shocks by permitting wider range of ex–post smoothing mechanisms to be used, which causes fewer distress sales of crops stocks or assets. Lipton (2007b) reports that in India, irrigated areas had 2.5 times lower standard deviation of crops output per year during the periods 1971–84. One of the main reasons for low productivity in agriculture all over the world, including Nigeria 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, particularly on cereals and pulses and vegetables (Goni; *et al*., 2007; Justice & Theresa, 2010). Tomato forms a very important component of many dishes and food consumed in Nigeria. Tomato production in Nigeria is mainly smallholder activity characterize with low productivity mainly due to the inability of farmers to

exploit the available technologies fully, resulting in lower efficiencies of production. The productivity in most of the crops is relatively low in Nigeria compared to the world average and the reasons quoted for it are non–adoption of available hybrid/HYV seeds, pests, diseases and nutrient management technologies and irrigation.

In the Jos Plateau as a result of open cast tin mining activities that took place, many mining ponds were created on the surface which acts as water reservoir. Tin mining involved excavation of soil and drilling down to locate the tin, with a machine called the drag line, which lifted the top soil off. Then a monitor or a big hose is used to blast the area where the top soil has been removed from where the tin was located .The soil would then be mixed with water to form slurry which facilitated separation of sand, water and tin. At the end of this process large burrow pits were left, which are now impounded with water, and the communities now found it very useful for irrigated farming. The study is aimed at identifying the socio–economic characteristic of tomato growers using tin mining ponds and evaluates constraints faced by these farmers.

MATERIALS AND METHODS

The study was conducted in Barkin Ladi local Government of Plateau State Nigeria. It is located between latitude 8º30' and 10º30' N and longitude 7º30' and 8º37' East with a land mass covering 53,585 square kilometers. The Plateau is some 300–600 m above the surrounding plains (Alexander & Kidd, 2000). At this altitude, the monthly mean temperature is about 20–24^{0}C. Rainfall on the Plateau totals about 1400 mm annually, which falls primarily over a period of 7– months from April to October. A two stage random sampling technique was employed in drawing sample for the study. In the first stage, four communities were selected from 120 communities involved in the use of mining ponds for irrigation farming. The second stage entails the random selection of 5 % of tomato farmers in each of the selected community. A total 89 tomato farmers were randomly selected for this study. The four communities were: Rakum–Kassa; Gana–Ropp; Dorowa–Babuje and Barkin–Ladi. These communities were the most prominent in tomatoes production using tin mining ponds. The second stage involved random selection of 89 respondents out of the 416 tomato growers identified in the communities with the help of extension agents and the community leaders. The number of respondents drawn from each community was as follows; Kassa 26, Barikin–ladi 9, Dorowa Babuje 35 and Gana Ropp 19, this gave a total size of 89.

The primary data for this study was collected based on 2008/2009 cropping season, data were collected using structured questionnaire. The information collected include educational status, age, sex, household size, years of experience in tomato production, input used, technologies, yield and income. In all 88 questionnaires were returned and completed satisfactorily for analysis.

Depreciation (D) = $\frac{P-S}{n}$ ——————— (2)

Analytical Technique

Data obtained were subjected to budgeting technique, multiple regression and simple descriptive statistics (Kudi *et al*., 2009).

The Descriptive Statistics

Simple descriptive statistics including percentages, rank, ratio, averages and frequencies was used to achieve objective N–LOGIT version 4.0.1 was used for the analysis.

Net farm Income Analysis

The Net Farm Income as a tool of partial budgeting was employed. This is because irrigation farming has fixed cost elements such as the depreciation of movable water pumps, hoes, cutlasses and hoses.

The model used in estimating net farm income is as shown below

$$NFI = \sum_{i=1}^{n} P_i Y_i - \sum_{j=1}^{m} P_{xj} X_j - \sum_{k=1}^{k} Fk \text{ ———(1)}$$

NFI = Net farm income
Yi = Tomato or Pepper output (tonnes)
Pi = Unit price of the of tomatoes or pepper (₦/kg)
Xj = Quantity of the variable input
(**where** j = 1,2,3,……m. variable input)
Pxj = Price per unit of the variable inputs (₦)
Fk = Cost of fixed inputs (₦)
where k = 1, 2, 3,…….k fixed inputs

Variable costs considered were cost of inputs: such as land preparation, seeds and seedlings cost; cost of fertilizer; cost of labor for different farm operations; cost of agrochemicals and cost of petroleum products. The total revenue was estimated by multiplying the quantity of tomatoes or pepper output by the price sold at the time of harvest (₦/kg). The fixed cost elements that were considered are depreciation of the movable water pump, hoses, and hoes. Straight line depreciation method was applied to determine the depreciated values. The straight line depreciation method assumes that an asset looses value at constant rate. This method is therefore useful for asset that looses value constantly over their entire life. Depreciation by this method is the difference between the purchase price (P) and the salvage value (S) divided by the number of years of life of the asset (n).

Socio–economic Variables

The multiple regression models for socio–economic variables influencing farmers' profitability was implicitly expressed as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9 u)$ ———————— (3)

Where;

Y = Income from tomato production (Naira)
X_1 = Age of farmer (years)
X_2 = Household size (number)
X_3 = Membership in farmers Cooperative Organization (dummy)
X_4 = Amount of credit (Naira)
X_5 = Co–operative membership (dummy; 1 member and 0 otherwise)
X_6 = Access to extension workers during the cropping season (dummy)
X_7 = Type of tomato seed used (dummy; 1 recycled seed and 0 otherwise)
X_8 = Years of experience in irrigated tomato production (years)
X_9 = Land tenure (1 owned farm and 0 otherwise)
u = Stochastic term.

Linear multiple regression model

$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + e_i$ ——— (3)

Where,

Y, X_1–X_9 are as already defined in the implicit form
$b_1 - b_9$ are regression coefficients
a = constant term
e = error term which was included to capture the effect of exogenous and endogenous variables not included in the model and also to capture errors of measurement, and in addition randomness of human behaviors.

RESULTS AND DISCUSSION

The distribution of tomato farmers by socio–economic characteristics is presented in Table 1. Over 74 percent of the farmers are within the age bracket of 20–42 years while about 26 percent are in the age bracket of 43–75 years. The mean age of the farmers is about 37 years. The average household size is 8 and family labour supplied about 48 percent of the total labour input for irrigation, weeding and transplanting. While hired labour input was made use of mostly in the ploughing harvesting and packaging. About 67 percent of the farmers own between 0.5–3.364 ha(s), while about 33 percent of them owns more than 3.365 ha(s). 78 percent of the farmers are male. More than 77 percent of the farmers had tomato farming experience between 3–21 years and 23 percent had experience of between 22–50 years. Only about 10 percent of the farmers had no any form of education, while about 48 percent had attended primary school and 12.5 percent had attended secondary school and above. In terms of credit only 26 percent of the farmers had access to credit for farming and mainly from informal source. Only 8 farmers (9 %) had contact with extension agents and 20 farmers (22.7 %) belongs to a formal cooperative group.

Table 1: Distribution of Farmers based on socio–economic characteristics (N=88)

	Socio–economic characteristics	Frequency	Percentage (%)
A.	***Age (Years)***		
	20–31	27	30.34
	32–42	39	43.82
	43–53	14	15.73
	54–64	6	6.74
	65–75	2	2.25
B.	***Household Size***		
	1–6.6	48	54.55
	6.7–14.2	29	32.95
	14.3–20.8	7	7.95
	20.9–27.4	2	2.27
	27.5–34	2	2.27
C.	***Gender***		
	Male	69	78
	Female	19	22
D.	***Marital status***		
	Married	68	77.27
	Single	20	22.73
		88	100
E.	***Farm size (ha)***	59	
	0.5–3.364	19	67.04
	3.365–6.228	3	21.59
	6.229–9.092	7	3.41
	> 9.093		7.96
F.	***Experience in irrigation (Years)***		
	3–12.4	28	31.82
	12.5–21.8	42	47.73
	21.9–31.2	14	15.91
	31.3–40.6	2	2.27
	40.7–50	2	2.27
G.	***Level of Education***		
	No any form of education	9	10.23
	Qur'anic education	25	28.41
	Primary school	43	48.86
	Vocational school	2	2.27
	Secondary sch. And above	9	10.23
H.	***Access to credit***		
	Yes	23	26.13
	No	65	73.87
I.	***Amount of credit***		
	5000–244000	19	82.61
	245000–483000	3	13.04
	>484000	1	4.35
J.	***Total(N=23)***	**23**	**100**

Table 2: Estimated Net Farm Income Analysis per hectare

Details		Unit/ha	Unit price	Value (N)/ha	% of cost/ha
A	Yield/ha	3370.62	82.79	279,053.63	
B	**Variable cost**				
	1. Seed (gm/ha)	162.58	16.33	2654.93	1.78
	2. NPK(kg/ha)	204	84	17,136.84	11.5
	3. Urea (kg/ha)	98.5	80	7880	5.29
	4. SSP (kg/ha)	77.99	60	4680	3.14
	5. Cow dung (kg/ha)	234.86	9.5	2231.17	1.5
	6. Poultry litters (kg/ha)	539.82	12	6477.84	4.34
	7. Herbicides (lit/ha0	1.89	900	1615	1.14
	8. Insecticides (lit/ha0	2.28	850	2052	1.30
	9. Petrol (lit/ha)	34.75	70	2432.5	1.63
	10. Labour (man–hr/ha)	783	110	86225.70	57.84
C	**Total variable cost**			**133,366.00**	
D	**Fixed costs**				
	1. Ground Rent	1	11250	11250	7.55
	2. Depreciation on motorised pump and farm implements	1	4442.38	4442.38	2.98
E	**Total Fixed Cost**			15,692.38	
F	**Total cost (C+F)**			149,058.38	
G	**Net Farm income(A–F)**			129,994.34	
H	**Return to Naira invested**			0.87	

Analysis of Costs and Returns of Tomato Production

In any business venture, the details of costs and returns provide an idea of profitability. Cost of production refers to expenses incurred in producing quantities of the product in a particular time period. The prevailed market prices of inputs and output at the time of harvest for 2008/2009 was used in calculating cost of production and returns. In determining the profitability of an enterprise, the return must be higher than the total costs incurred if the business is to remain solvent. An average variable cost per ha of ₦133,366.00 were incurred on tomato production, and this accounted for 89.47 % of the average total cost of tomato production. The total fixed cost consists of land rent, depreciation on motorized water pumps including accessories, and farm implements, the average amount spent by the farmers per ha was ₦15692.38. This represents 10.53 % of the total cost of production as shown in Table 2. The analysis revealed that the average cost of cultivating a hectare of tomato was ₦149,051.46. Gross return was obtained by multiplying the total output of tomato by the price. Average price of ₦82.79 k per kilogram was obtained from December to April respectively. This analysis revealed that the average gross return per hectare was ₦279,063.35 for tomato production under irrigation in the study area.

Net Farm Income

This is the difference between the total value of output and the total cost. Table 2 reveals that an average net farm income of ₦129,994.34 per hectare accrued to tomato farmers. The result shows that a return to naira invested in tomato production under irrigation using tin mining ponds was ₦0.87 k which

indicates the profitability of irrigated tomato production.

Multiple Regression Function Results

The results of the multiple regression models are summarized in Table 3. The result shows that the coefficient of determination (R^2) has a value of 0.44. This implies that 44 % of the variation in income of the irrigated tomato farmers was explained by the variables in the model. It also has a high F–value which was significant at 1 % which signifies the rejection of the null hypothesis that the socio–economic variables have no effect on the tomato farmers' income. Both household size and credit amount have the expected positive coefficients which are statistically at significant at 1 % probability level. It is expected when household size is large the problem of labour will be minimized, and also credit amount at the disposal of the farmer will also enhance his timely farm operation and therefore are all in line with *apriori* expectation. This significant influence of credit on farm income agreed with the findings of (Bhatta *et al*., 2010; Apata *et al*., 2010). However the finding contradicts the report of Adeolu & Ayanwale (1995), where credit was negatively related to production of Gari and Lafun in Oyo north. They suggest that the repayment conditions of credit may not be totally favourable. Experience in irrigation farming and access to extension were found to be negatively influence the farmer income and statistically significant at 10 % probability level. The negative coefficient of experience in irrigation farming indicates that recent innovation in the form of production and agronomic practices are not adopted by the more experience farmers and thereby resulting in negative income. While contact with extension agent also influence income negatively, this contradict the *apriori* expectation that contact with extension agent will influence farmer income positively. But this might be indicative of the fact that farmers that contacted the extension agents did not gained any advantage over those that are not in contact with extension agent, this may be due to inexperience and lack of trainings of the extension agents in terms of irrigated tomato production which lead to the mismanagement of time and resources of the farmer.

Table 3: Regression Estimates of Socio–economic Determinants of Farmers Income from Irrigated tomato production

Variable	Coefficient	Std. Error	t–ratio	P	Mean of X
Age	793.877	7915.02	0.100	0.9204	37.6136
Household size	38854.45	11666.39	3.330***	0.0013	7.84
Years of Education	–7482.58	14403.98	–0.519	0.6049	4.6931
Credit	2.2498	0.4280	5.256***	0.0000	37089.78
Co–op membership	–59053	146176.84	–0.404	0.6873	0.2272
Access to Ext.	–331487	195619.05	–1.695**	0.0941	0.8750
Used of recycled seed	–89423.40	130403.87	–0.686	0.4949	0.8750
Exp. In irrigation farming	–13602	8172	–1.664**	0.1000	16.8636
Land tenure type	128509	136278.89	0.943	0.3486	0.7386
constant	383313	289796	1.323	0.1898	
R–Squared	0.44				
Adjusted R–Squared	00.37				
F–Statistics, $F_{9,78}$	6.84(0.0000)***				
Log likelihood	–1281.409				

Constraint to Irrigated Tomato Production

The constraints to irrigated tomato production were the problems limiting dry season tomato production in the study area. These constraints are ranked in Table 4. The analysis of the constraint reveals that lack of capital ranks first which limit the farmers opportunity to capitalize their tomato enterprise, followed by in accessibility to subsidized fertilizer which exposed the farmers to procured high cost fertilizers in the open market, unavailability of fertilizer, high cost of fertilizer which lead to adulteration of fertilizers, which in turn result to massive crop failure and reduce farm income. Then high cost of motorized water pumps which jack up the fixed cost of production; output price fluctuation; poor seeds also exposed them to lower yield. The land tenure problems limit farmers ability to manage their plots continually for over a long period of time, and shortage of irrigation
water due to competition as result of more farmers are getting into irrigation farming year in year out. Frequent civil disorder, poor infrastructures, health service facilities, poor extension services and personnel are among the prominent constraints to farmers' productivity.

Table 4: Ranking of problems faced by Tomato farmers using Tin Mining ponds

Problem	%	Ranking
Lack of capital	90	1st
Inaccessibility to fertilizer	91	2nd
Unavailability of fertilizer	88	3rd
Fertilizer not affordable	85	4th
Adulteration of fertilizer	77	5th
High cost of water pumps	75	6th
Output price fluctuation	74	7th
Poor quality seeds	74	7th
High cost of ground rent	66	9th
Shortage of water	65	1 0th
Civil disorder and rioting	64	11th
Inaccessibility to subsidized inputs	61	12th
Poor and non availability of extension service	60	13th
Poor and high cost of health services	55	14th
Poor roads network	53	15th
High cost of transport	50	16th
Absence of bank	50	16th
Cumbersome administrative procedure to secure loan	45	18th
High interest rate	39	19th
High ways insecurity	38	20th
Poor processing and storage facilities	33	21st
Poor information dissemination	30	22nd
Land degradation	22	23rd
Health and diseases	20	24th
Loss of lives as result of drowning	20	24th
Loss of animals	5	26th

CONCLUSION

Findings from the study reveals that most of the farmers do not have access to credit and tomato production is male dominated in the study area. The average age of the farmers was 37 years indicating that they are active and able men and women and majority of them had attended at least primary school education, the cost of labour was tend to be very high. The study also indicates that tomato production in the study area was profitable with an average net farm income per hectare of ₦129,994.34 k and return per naira invested to be 87 k. The analysis also reveals that household size and credit influences farm income positively significant, while experience in irrigation farming and extension contact had negative influence on farm income. Majority of the farmers indicate lack of access to credit as their main constraint to production and even those that access the credit the amount was very limited. The findings of the study indicate that financial institution should be mobilize to the area and make loans available and accessible to the farmers so that they can afford to increase their farm income. Also there is need for government and other institutions to provide quality extension services that will educate the farmers to improve their use of farm resources in order to enhance the profitability of their business.

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