ANALYSIS OF YAM MARKETABLE SURPLUS IN IMO STATE, NIGERIA

Onyenobi, V.O[1]., Okoye B.C[1]., Ezeh, C.I[2]., Ewuziem, J.E[1]., Ogbonna, M.C[1] and Mazza, Mary-Ann[1]

[1]National Root Crops Research Institute Umudike, P.M.B. 7006, Umuahia, Abia State, Nigeria
[2]Department of Agricultural Economics and Extension, Abia State University, Umuahia Campus, PMB 7010, Umuahia, Abia State, Nigeria
Email: onyenobivincent@yahoo.co.uk

ABSTRACT
This study was conducted in Imo State in the southeastern agricultural zone of Nigeria, to determine socio-economic characteristics of farmers; cost and return of farmers and factors that determine the marketable surplus of farmers. Among the farm enterprises in the state, yam has high- income elasticity of demand by consumers when compared to other root and tuber crops cultivated in the state. Multistage sampling technique was employed while well-structured questionnaire and oral interview were used to collect field data from respondents. Both descriptive statistics and Ordinary Least Squares (OLS) multiple regression model were used to analyze the data from the field. Results of the study showed that the farmer realized N318150 ha^{-1} from 3030 $kgh^{-1}$of yam tubers in marketable surplus. It was implied from the results that increase in the farmer's age, transportation cost and household size will significantly lead to decrease in the yam marketable surplus in the study area. Increase in non-traded yam will lead to increase in yam marketable surplus if the quantity of yam produced per hectare increases. Increase in farming experience, marketing experience, and cost of seed yam will significantly lead to increase in the yam marketable surplus of the farmer. These results call for promulgation of policies to improve farm production efficiency in the study area.

Keywords: yam, marketable surplus, production, roots and tubers

INTRODUCTION
In Nigeria, yam is the most important staple energy food crop when compared with the other root and tuber crops such as cassava, sweet potato and cocoyam.The crop contributes significantly to national economy and rural income by providing employment to many rural dwellers (Asumugha *et al.,2010*) and cheap carbohudrate staple food for over 80 percent of the populace (Nwachukwu, 2008), thereby reducing poverty level (Emokaro and Law-Ogbomo, 2008).

Also in Nigeria, yam has attained substantial commercial importance (Acquah and Evange, 1991). Nigeria is the largest producer of yam in the world (Orkwor *et al*., 1998; FAO, 2013). In 2007, annual production of yam in Nigeria was estimated at 30 million tonnes representing 71 percent contribution to the estimated world production figure of 52 million tonnes (FAO, 2007). In 2012 annual production of yam in the world was estimated at 57 million tonnes, while the figure for Nigeria was estimated at 37 million tonnes (FAO, 2013). This implies that Nigeria contributed 64 percent to world production in 2012 down from 71 percent in 2007, indicating stagnation and/or decline in yam production in Nigeria (Aboki, 2013; Asumugha *et al.*, 2009; FAO, 2013). Production of yam in Nigeria is carried out by smallholder farmerswho cultivate less than 1.0 ha per household (Onyenweaku, 1994; Nwaru, 2003 and Iheke, 2006. In Nigeria, especially Imo State, the growth in population and

aggregate demand for food or ware yam have made the production and marketing of yam assume great importance. In Nigeria, however, yam supply has not kept pace with population growth, leading to demand exceeding supply (Kushwaha and Polycarp, 2001), and this gap between the estimated annual supply and demand for yam still remains at over 20 million metric tonnes per annum (NRCRI, 2009). Constraints to yam production have been identified to include high cost of planting material, labour, declining soil fertility, low yielding varieties as well as pests and diseases (Asumugha *et al*., 2009). Notwithstanding these constraints, to meet the annual demand, yam production must increase by 3-4 percent (IITA, 1985), in order to contend with yam supply for household consumption and yam marketable surplus for income generation.

Yam marketable surplus which is the excess of the household total yam production over the non-traded quantity of yam consumed by the household is fundamental for economic development of Nigeria. This is because agricultural marketable surplus contributes to capital formation in non-agricultural sector, improvement in standard of living by generating income for households and providing raw materials for industries (Awotide, 2004), as well as help conquer poverty, food insecurity and malnutrition (Mkpado and Onuoha, 2010). However, yam marketable surplus may be influenced by factors such as size of holding, level of productivity, family consumption requirements for food, seed input, kind payments for religious and social purposes, and prices of the product (Reddy *et al*, 2006). Increase in smallholder yam marketable surplus depends on efficiency of farm resources (land, labour, capital, seeds, fertilizer and pesticides), whose supply and price affect the productivity of the farm; pest control practices; rural infrastructure; agricultural extension and technology transfer; research and development; yam storage, processing and marketing; farm credit; farm insurance; agricultural cooperatives; training and manpower development; and agricultural statistics and information management (Njiforti and Haliru, 2012)

The marketable surplus is usually made available for sales at the market through marketing activities. This study, therefore, aimed at determining the effect of yam marketable surplus on economic development of Imo State, while the specific objectives were to determine: (i) socio-economic characteristics of farmers; (ii) cost and return of farmers; and (iii) factors that determine the marketable surplus of farmers in the study area.

METHODOLOGY

Study Area

The study was conducted in Imo State, which is located in the southeastern agricultural zone of Nigeria. Imo State is one of the 36 states in Nigeria. The state has a land area of 5,530km^2, and a population of about 3.939 million. The state has 27 local government areas each of which has several communities and villages. It has 3 agricultural zones, Orlu, Okigwe and Owerri. (NPC, 2006). The area lies between latitudes 5.2^{o}N and 6.08^{o}N and longitudes 6.6^{o}E and 7.5^{o}E. The area has tropical climate marked by high rainfall of between 15000mm-20000mm and temperature range of 34^{o}C-37^{o}C. Agriculture is the major occupation of people of the state. Major root and tuber crops cultivated in the state include cassava, yam, sweet potato and cocoyam. Imo State is chosen for the study, because among the farmers in the state yam has high- income elasticity of demand by consumers when compared to other root and tuber crops cultivated in the state.

Data Collection method

The study was conducted in Imo State, using multistage sampling technique. Two (2) Agricultural Zones were randomly selected from the 3 Agricultural Zones in Imo State. Four (4) Local Government Areas that produce yam comprising 2 local Government Areas from

each Agricultural Zone were randomly selected for the study. A total of 120 farmers comprising 15 farmers from each of the 2 communities randomly selected from each Local Government Area were used for the study. A well-structured questionnaire and oral interview were used to collect random field data from respondents. Data were collected on socio-economic characteristics of farmers, specific prices of inputs and output of yam, and determinants of yam marketable surplus in the study area.

Data Analysis

Determinants of yam marketable in the study area were estimated using the Ordinary Least Squares (OLS) multiple regression model which is implicitly represented as follows:

$Y = f(X_1, X_2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X_{15,} e_i)$

Where:

Y = Mean yam marketed surplus per household (kg); X_1 = Sex of farmer (dummy variable, 1=male, 0=female); X_2 = Age of farmer (years), X_3=Marital Status (dummy variable, married=1, 0=otherwise); X_4 = Household size; X_5 = farm size (ha); X_6 = Educational level (years); X_7 = Farming experience (years); X_8 = Distance from household- to -farm (km); X_9 = Distance from household –to- farm gate market (km); X_{10} = Farm Technology (semi-mechanized, 0=traditional); X_{11} = Non-traded yam output of farmer (kg ha^{-1}); X_{12} = Transportation cost of yam (N kg^{-1}); X_{13} = Marketing Experience (years); X_{14}= Cost of Seed yam (₦ ha^{-1}); X_{15}= Cost of Labour input (₦ ha^{-1}); ei= Error term

RESULTS AND DISCUSSION

Table 1 indicates that among the farmers surveyed in the study area, 73.33 percent were males because the men had more right to land as productive resource than the women. The mean age of the farmers was 41.82 years indicating that they were young to withstand the stress in yam production for household consumption and market supply for cash income. Most of the farmers (76.67 percent) were married, with farm size of 0.8 ha, household size of 7 persons and this led to lower the cost of hired labour for yam production for domestic consumption and market supply for cash income. Also the farmers had educational level of 9 years, farming experience of 9.67 years, distances from the household to the farm were 0.35 km and from the household to the farm gate were 0.93 km, and marketing experience of 7.58 years.

Table 2 shows the mean cost and return of yam farmer in the study area. The farmer earned a total income of ₦138600 ha^{-1} from 13200 kg ha^{-1} of yam tubers. This represented ₦1067850 ha^{-1} from 10170 kg ha^{-1} in non-traded yam tubers for domestic consumption, and ₦318150 ha^{-1} from 3030 kg h^{-1} of yam tubers in marketable surplus. The total cost of yam production estimated at ₦96400 ha^{-1} comprised the total fixed cost of ₦57500ha^{-1} and the total variable cost of ₦906500ha^{-1} incurred by the farmer in the study area. These resulted in gross margin of ₦479500ha^{-1} and net margin of ₦ 422000ha^{-1} on trade.

Table 3 shows the estimated OLS regression result of the determinants of the marketable surplus of yam farmers in the study area. The double log functional form was chosen as the lead equation for the study. The R^2value was 0.8873, indicating that 88.73 percent of the variations in the yam marketable surplus of the farmer were significantly explained by the variables investigated in the study area. The coefficients of the farmer's age (X_2) and transportation cost (X_{12}) were negative and highly significantly related to the yam marketable surplus at 1 percent probability level, while the household size (X_4) was negative

The mean age of the farmer was 41.82 years implying that most of the farmers in the area are middle aged, and that increase in the farmer's age is likely to lead to decrease in yam

marketable surplus of the farmers. The negative effects transportation cost of marketable surplus to the nearest market for sale and increased household size with a large proportion of dependents will significantly lead to decrease in marketable surplus for non-traded yam for household consumption. The negative coefficient of farm size implies that increase in farm size on marginal land without adequate improvement will significantly lead to a decrease yam marketable surplus of the farmer in the study area. The coefficient of non-traded yam (X_{11}) for household consumption was positive and highly significantly related to the yam marketable surplus at 1 percent probability level. This implies that increased supply of non-traded yam for household consumption is likely to increase as yam marketable surplus increases if the quantity of yam produced per hectare increases.

The coefficients of farming experience (X_7) and labour input (X_{15}) were positive and significantly related to the yam marketable surplus at 1 percent probability level, according to *a priori* expectations. More experienced farmers are expected to have higher level of technical efficiency leading to more output than their counterpart who are not experienced (Okoye *et al.,* 2008). Increase in labour supply for yam production from cheap household labour and unemployed labour from alternative farming activities will lead to increase in yam marketable surplus, *ceteris paribus*. The coefficients of marketing experience (X_{13}) and cost of seed yam (X_{14}) were positive and significantly related to the yam marketable surplus at 5 percent probability level. Marketing experience enables the farmer procure fairly costly improved seed yam that significantly leads to increase in the yam marketable surplus of the farmer. Also, the farmer's sex (X_1) and implying that increase in the number of male farmers is likely to increase the yam marketable surplus.

CONCLUSION

The results of the study indicated that the farmer produced a total of 13200 kg ha^{-1} of yam tubers representing 10170 kg ha^{-1} in non-traded yam tubers for domestic consumption, and 3030 kg h^{-1} of yam tubers in marketable surplus. These gave a gross margin of ₦479500ha^{-1} and net margin of ₦422000ha^{-1} on trade. The important factors that influenced the yam marketable surplus in the study area include; farmer's age, transportation cost, household size, as well as non-traded yam, farming experience, marketing experience and cost of seed yam. These results call for promulgation of policies to improve the relations between the total output, non-traded yam, yam marketable surplus and marketing margin in the study area. Such policies should aim at youth empowerment based on improved transportation, availability of improved seed yam and adequate soil improvement in the study area.

Table 1: Socio-Economic Characteristics of Yam Farmers in Imo State, Nigeria

Variables	No. of observations	Mean	Percentage
Sex			
Male	88		73.33
Female	32		26.67
Total	120		
Age (years)	120	41.82	
Marital status			
Single	5		4.17
Married	92		76.67
Divorced	4		3.33
Widowed	19		15.83
Total	120		
Household size	120	7	
Farm size (Ha^{-1})	120	0.8	
Educational level (years)	120	9	
Farming experience (years)			
Distance from household to farm (km)	120	0.35	
Distance from household to farmgate (km)	120	0.93	
Marketing experience (years)	120	7.58	

Source: field survey Data, 2012

Table 2: Mean Cost and Return of Yam Farmers in Imo State, Nigeria

Item	Quantity per Ha	Unit value	Amount ₦ ha^{-1}
Revenue			
Non-traded yam	10170 kg	105	1067850
Yam marketable surplus	3030 kg	105	318150
Total Revenue (TR)	13200kg	105	1386000
Fixed Cost (FC)			
Rent on land	1 Ha	55000	55000
Depreciation of farm assets	1 Ha	2500	2500
Total Fixed Cost (TFC)		57500	57500
Variable Cost (VC)			
Planting material (seed yam)	4750 kg	95	451250
Stake material	2500	75	187500
Fertilizer	6 bags	6.50	9000
Herbicide			6000
Transportation			15000
Labour			
Land preparation	55 MD	850	46750
Herbicide application			4500
Fertilizer application	25 MD	850	21250
Staking	2500 stakes	10	25000
Weeding (2^{nd} and 3rd)	110 MD	850	93500
Harvesting	55	850	46750
Total Variable Cost (TVC)			906500
Gross Margin (TR-TVC)			479500
Net Margin (GM-TFC)			422,000

Source: field survey data, 2012

Table 3: Estimated OLS Determinants of Marketable Surplus of Yam Farmers in Imo State, Nigeria

Variable	Linear form	Exponential form	Semi log Form	Double log form +
Constant	-8616.259	10.321	35096.6	-22.026
	(-0.55)	(4.10)	(0.08)	(-1.64)
Sex (x1)	455.677	0.047	-115.568	0.022
	$(1.86)^x$	(1.21)	(-0.23)	(1.41)
Age (x_2)	-45.853	-2.88e-04	260.737	-0.093
	(-3.25) **	(-0.13)	(0.43)	(-5.11) ***
Marital status (x_3)	-276.624	-0.014	-657.360	-0.010
	(-3.12) **	(-0.13)	(-2.28) **	(-1.19)
Household size (x_4)	-23.761	-0.003	-111.598	-0.032
	(-0.52)	(-0.40)	(-0.18)	(-1.77) *
Farm size (x_5)	7.859	-0.009	-9.4422	-0.018
	(-0.04)	(-0.26)	(-0.02)	(-1.77) *
Education level (x_6)	21.607	-0.002	-183.399	-0.006
	(0.84)	(-0.54)	(-0.30)	(-0.35)
Farming experience(x_7)	107.104	0.001	-216.053	0.047
	(2.48) **	(-0.14)	(-0.33)	(2.39) **
Household to farm distance (x_8)	227.081	0.021	552.742	0.005
	(1.16)	(0.66)	(0.61)	(0.40)
Household to market distance (x_9)	124.103	0.005	239.549	0.008
	(0.72)	(0.18)	(0.69	(0.80)
Farm technology (X_{10})	277.197	-0.044	68.130	-2.11E-02
	(0.78)	(-0.78)	(0.09)	(-0.97)
Non-traded output (X_{11})	0.729	4.09E-05	944.982	0.180
	(3.80) ***	(1.34)	(0.78)	(4.93) ***
Transportation cost (X_{12})	-6988.547	-0.188	-3837.813	-0.639
	(-9.87) ***	(-1.66)	(-2.23) **	(-12.29) ***
Marketing experience (X_{13})	59.390	0.004	541.495	0.040
	(1.57)	(0.70)	(1.10)	(2.71)**
Cost of seed yam (X_{14})	0.076	1.28E -06	-21032.59	2.261
	(3.06) **	(0.32)	(-0.92)	(3.27) **
Labour input (X_{15})	-0.027	-5.45E-06	19783-37	0.081
	(-0.50)	(-0.64)	(0.76)	(0.10) **
R^2	0-8133	0.1810	0.2788	0.8873
Adjusted R^2	0.7864	0.0629	0.1599	0.8688
F-Ratio	30.21***	1.53	2.34	47.78***

Source: field survey data, 2012.
*****, **, *, = significant at 1%, 5% and 10%, respectively.**
Figures in parentheses are t-ratios.

REFERENCES

Aboki, P.M. (2013). Analysis of Resource Use in Yam Production in Lafia LGA of Nasarawa State, Nigeria. *Proceedings of the 47th Annual Conference of the Agricultural Society of Nigeria.* 4th-8th Nov. 2013. Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Oyo State, Nigeria. Pp 422-426.

Acquah, E.T. and Evange, N.E. (1991). An Economic Examination of Constraints and Opportunities of Yam (*Dioscorea spp).*

Production in Faco Division, Cameroon, *Tropical Root Crops Proceedings of the 9th Symposium of the ISTRC* Held at Accra Ghana from 20-26 October 1991. Pp. 367-372.

Asumugha, G.N., Njoku, M.E., Okoye, B.C., Aniedu, O.C., Ogbonna, M.C. and Nwosu, K.I. (2009). Demand function and elasticity for seed yam in northern Nigeria. *Niger Agric. J*., 40(1&2).

Asumugha, G. N., Njoku, M. E., Okoye, B. C. Akinpelu, O. A. Anyaegbukanam H. N. and Nwosu, K. O. (2010). Emperical Estimation of Demand Function and Elasticities for Seed Yam in Southern Nigeria. *Africa Journal of Root and Tuber Crops* (2010) vol. 8. NO. 1 pp 56-61.

Awotide, D.O. (2004). Resources use Efficiency and Input Substitution in Upland Rice Production in Ogun State, Nigeria Unpublished

Ph.D *Thesis*, Department of Agricultural Economics, University of Ibadan, Ibadan, Oyo State, Nigeria.

Emokaro, C. O. and K. E. Law-Ogbomo (2008). The Influence of Minisett Size on the Profitability of Yam Production in Edo State, Nigeria, *Research Journal of Agricultural and Biological Sciences*, 4 (6): 672-675.

Food and Agriculture Organisation (FAO) (2007). FAO Statistics. Rome Italy.

Food and Agriculture Organisation (FAO) (2012). FAO Statistics. Rome Italy.

Food and Agriculture Organisation (FAO) (2013). FAO Statistics. Rome Italy.

International Institute for Tropical Agriculture (IITA), (1985). A System to Increase Seed Yam Production. *Root and Tuber Improvement Programme. Research Highlight 1981-1984*, IITA, Ibadan, Nigeria, pp 44-49.

Iheke, O.R. (2006). Gender and Resource Use Efficiency in Rice Production Systems in Abia State of Nigeria. *MSc Thesis*, Michael Okpara University of Agriculture, Umudike.

Kushwaha, S and Polycap, I.M. (2001). Economic Of Small Scale Yam Production in Qua'an Pau L.G.A of Plateu. In Abubakar M.M.; T.A.

Adegbola and I.S.R. Bustwat (Eds), The Role of Agric in Poverty Alleviation, Proc. 34th Conference of Agric Society of Nigeria, Held at Abubakar Tafawa Belewa University (ATBU) Bauchi, Oct 15-19, 2001, 64-74.

Mbah, S.O. (2013).Economic Analysis of Cocoyam Production in Biase Locall Government Area of Cross River State, Nigeria. *Proceedings of the 44th Annual Conference of the Agricultural Society of Nigeria*. 4th- 8th Nov. 2013. Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Oyo State, Nigeria. Pp 422-426.

Mkpado, M. and Onuoha, R.E. (2010). Determination of Marketable Surplus of Cassava Tubers in Ahiocha Local Government Area of Anambra State, Nigeria. Proceedings of the 47th Annual Conference of the Agricultural Society of Nigeria. 18th-22nd Oct. 2010. LAUTECH Ogbomoso, Oyo State Nigeria. Pp 587-591.

National Root Crops Research Institute (NRCRI), Umudike . *Annual Report*, 2009, 97.

Njiforti, P.P. and Haliru, I. (2012). Analysis of the Impact of the New Agricultural Policy on Agricultural Sector in Nigeria. *Proceedings of the 44th Annual Conference of the Agricultural Society of Nigeria*. 5th-9nd Nov. 2012. Faculty of Agriculture, Bayero University, Kano, Nigeria. Pp 172-179.

Nwachukwu, E. C. (2008). *Dioscorea* Cayanensis (Yellow Yam) Development and Popularization. *2008 National Root Crops Research Institute (NRCRI) Umudike Annual Report*. P 90.

Nwaru, J.C. (2003). Gender and Relative Production Efficiency in Food Crop Farming in Abia State of Nigeria. *The Nigerian Agricultural Journal*, 34: 1-10.

Okoye, B.C., Onyenweaku C.E.and Agwu, A.E. (2008). Technical efficiency of smallholder cocoyam farmers in Anambra state, Nigeria. Implications for agricultural extension policy. Journal of *agricultural extension,* 12(1):107-116

Onyenweaku, C.E. (1994). "Economics of Irrigation in Crop Production in Nigeria". *Issues in African Rural Development* 2, Bret, S.A.(ed), Arlington, USA: Win Rock International Institute for Agricultural Development/African Rural Social Sciences Research Network. Pp 129-138.

Orkwor, G. C. Okereke, O. U.; Ezedinma, F. O. C; Hahn, S. K. Ezumah, H. C.; and Akobundu, I. O. (1991). The Response of Yam (*Dioscorearotundata* poir) to Various Periods of Weed Interference in an Intercropping with Maize (*Zeamays* L), Okra (*Abelmoschusesculentus* L.) and Sweet Potato (*Ipomea batatas* L.). Tropical Root Crops in a Developing Economy. *Proceedings of the 9th Symposium of the International Society for Tropical Root Crops* Held at Accra Ghana from 20-26 October 1991. Pp. 349-354.

Reddy, S.S., Ram, P.R., Sastry, T.V.N and Devi, I.B. (2006). *Agricultural Economics*. Oxford IBH Publishing Co. PV. LTD New Delhi. P. 492