DEMAND FUNCTION AND ELASTICITIES FOR SEED YAM IN NORTHERN NIGERIA

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ABSTRACT
This study employed the conventional demand function analyses to examine the influence of socio-economic variables on seed yam demand in Northern Nigeria. A multi-stage random sampling technique was used to select 150 seed yam farmers in three major States in 2006. Input-output data and their prices were obtained from the farmers. The study revealed that disposable income, labour and fertilizer exert significant influence on seed yam demand in Benue State. In the Federal Capital Territory Abuja, age and education had a direct relationship with seed yam demanded, while farmer experience has a negative effect. In Nasarawa State, education, disposable income and fertilizer had a direct relationship with value of seed yam demanded at 5%; farm size at1.0% while labour had an indirect relationship seed yam demand at 10.0%. The elasticity of demand for seed yams for farm size was elastic for Nasarawa state but inelastic for Abuja. The elasticities with respect to education for the two States were 0.6 and 0.28 respectively. Demand is price inelastic for Abuja and Benue States with respect to their own prices. The cross price elasticities for seed yams to the price of major substitutes were positive but for Nasarawa State. The income elasticities of demand for seed yams were all positive.. There is need therefore for policies aimed at encouraging farmers for increased cultivation of seed yams, improving farmers' access to productive inputs such as fertilizer. Farmers should be educated especially through extension services, trainings and orientation on the benefit of seed yam enterprise for increased commercialisation of the sector.

KEYWORDS: Seed yam, Demand, elasticities

INTRODUCTION

Yam (*Dioscorea* spp.) is an important tuber crop in Nigeria, where it is produced both as food and cash crop. Nigeria is the largest world producer of yams with annual production estimated at 26.587 million metric tones (FAO, 2006). Yam plays very significant roles in the diets of Nigerians. The importance of yams in Nigeria revolves on its high calories. Yam is also a socio-cultural crop. Yam in Nigeria is, however, becoming expensive in urban areas as production has not kept pace with population growth leading to demand exceeding supply (Kushwaha and Polycap, 2001).

There is equally the need for increased production of yam not only to satisfy domestic need but also export demand. Increased production of yam in Nigeria is still believed to be constrained mostly by high cost of seed yam (NRCRI, 2004). Large quantities of the edible yam, about 30% (3-5 tonnes per hectare) of the previous year's harvest are used to plant a new crop (Okoli and Akoroda, 1995). This has accounted for over 40% of yam production cost (Ugwu 1990, Nweke *et al* 1991). The minisett technique (involving the use of about 25 gramme cut setts to produce whole tubers which serve as "seed" of yam (Okoli and Akoroda, 1995) was developed to address the problem of high cost of seed yam.

Seed yam producers have several objectives for investing on seed yam production. Most of them produce seed yam essentially for the production of own ware yams (Asumugha *et al*, 2007a). Over 85% of the producers source their seed yams from the previous year's harvest.
Three types of seed yams were identified in Nigeria (Asumugha *et al*, 2007b). These are milked seed yam, Cut setts (minisetts) and small whole tubers. The use of small whole tubers and milked setts was more widespread among producers than the minisett technique. This is probably because small whole tubers and milked setts are often "bi-products" of ware yam production activity and this further reduces the burden of having a separate plot for seed yam production. Producers who had separate plots for seed and ware yam had a higher likelihood of adopting the minisett technique than those who produced the two yam types on the same plot.
Seed yam is a major item of cost in yam production. The minisett technique of seed yam production holds a lot of prospects for reducing the cost of seed yams. It is therefore necessary to understand the demand structure for seed yam to help producers and other entrepreneurs to better participate in the yam sub-sector.

There exist literatures on the empirical demand functions. Deaton and Muellbauer (1980b) reviewed some aspects of the demand functions, and enumerated the functional forms used in analyses of demand systems. Koutsoyiannis (1979) identified demand for a product as a multivariate relationship determined by many factors. Jumah *et al* (2004) and Adepoju (2006) employed the almost ideal demand system's (AIDS) technique via a cross-sectional model. The AIDS technique which is an econometric estimation is linear.
The basic model of demand states that the amount demanded of any good depends on the good's own price, consumers' income, the prices of substitutes and complements, consumers' preferences and perhaps other factors. Some researchers have expressed the need to consider a wider range of explanatory variables than the price and consumer income variables suggested by economic theory (Effiong and Njoku, 2001).

The broad objective of this study is, therefore, to analyze the demand for seed yams in major yam producing areas of Northern Nigeria. The specific objectives include to:

i. examine the socio-economic characteristics of the various participants in the seed yam sub sector in Northern Nigeria;
ii. estimate and analyze the demand functions for seed yams in these major producing areas of Northern Nigeria;
iii. examine the relative demand elasticities for seed yams in the region;
iv. make policy recommendations from the findings in the seed yams sub-sector.

The study aims to provide a basis for achieving the twin goals of food security and job creation. It is believed that more investment in this sector will generate new job opportunities and improve incomes for farmers through better prices and returns.

METHODOLOGY

The study area

The study was conducted in the major yam producing Northern States of Nigeria: Benue, Nasarawa, and the Federal Capital Territory.

Sampling procedure

A multi-stage random sampling procedure was adopted in the choice of States, seed yam producers/traders. Consequently, one out of three agricultural zones was purposively chosen from the Agricultural Development Project Zones in each of the selected States based on intensity of cropping. For each zone, 50 seed yam producers were randomly selected making a total of 150 yam producers.

Influence of Socio economic variables on Seed Yam demand

Data Collection:
Both primary and secondary data were used in the study. Primary data were generated through the administration of a set of structured questionnaire on the target respondents. Farmers were visited at homes and in their farms. Data collected include household characteristics and employment, major and minor occupation of respondents, household expenditure on seed yams, inputs, complements and substitutes. Also collected were value of seed yams in demand, price of seed yam and close substitute, income, household size and years of experience in seed yam production. Others included age and education of the household head; gender of the household head; farm sizes; labour availability; fixed inputs and value of credit if any. Secondary data were sourced from available literature and relevant research works in the area.

Data Analysis
Conventional demand function analyses via a cross-sectional model was employed to assess the influence of the variables mentioned above on the value of seed yam demanded. Descriptive statistics as well as linear regression models were applied to estimate the effect of the variables. Partial derivatives of the various elasticity formulae were estimated.
The demand function for seed yams was implicitly specified in equations (1)

$Y = f(age, edn, I, L, Fs, Exp, Ps, P, Fertkg, Vi, e)$ (1)

$Y = y_P + y_B$, (2)

$I = G_i - G_0$ (3)

Where:

Y	=	value of seed yams demanded in Naira
y_P	=	value of own produced seed yam in Naira
y_B	=	expenditure on seed yam purchase by growers to supplement own production in Naira
age	=	age of household head in years
edn	=	level of education of household head in years
I	=	disposable income of household in Naira
G_i	=	gross income of household in Naira
G_0	=	income given away in Naira
L	=	labour input in yam production in mandays
Fs	=	farm size in hectares
Exp	=	years of farming experience
Ps	=	price of close substitutes in Naira per kg
P	=	price of seed yams in Naira per kg
Fertkg	=	quantity of fertilizer used in kg
Vi	=	other variable inputs in Naira, (amount spent on pesticides and herbicides).
e	=	error term

Demand Elasticity for Seed Yam
Demand elasticity is defined as the responsiveness of demand to changes in price. For linear functions, price elasticity of demand can be written thus,

$E_d = \frac{d_q}{d_P} \times \frac{p}{q}$

$= b.P_i/q_i$

Where;

E_d	=	elasticity of demand
d_q	=	change in quantity demanded
d_P	=	change in price

P_i = mean value of the explanatory variables
q_i = mean value of the dependent variable
b_i = coefficient of the variables
Own price, cross price and income elasticities were also determined.

RESULTS AND DISCUSSION

Average Statistics of Seed Yam Farmers

The average statistics of the sampled seed yam farmers are presented in Table 1. Seed yam growers in Nasarawa State were middle aged. This is the active farming group. However, it could be said that for Benue and Abuja where the mean ages are 50 years and above, the farming household heads are aging and may not be very active in this sector for a long time. The mean number of years of schooling of the seed yam growers was about 6 and implies primary school leavers. Most of them grow seed yam as major occupation with mean farm size of between 1.0 and 4.7ha. The average disposable income is N281, 000 for farmers in Abuja, but below N200, 000 per annum for farmers in Benue and Nasarawa States.

Table 1: Average Statistics of Seed Yam Farmers in Northern Nigeria.

	Abuja	Benue	Nasarawa
Demand (N)	21,640.99	58200.00	19,634.90
Age (yrs)	50.14	51.50	40.34
Education (yrs)	6.30	6.88	5.88
Major Occupation	0.86	.9600	0.78
Income (₦)	281,510	135,240.00	115,754.00
Labour (Mandays)	200.73	149.76	225.00
Farm Size (₦)	4.69	.9314	1.86
Experience (yrs)	30.98	27.82	21.72
Price of major Substitutes (₦)	179.87	112.84	177.90
Price of Seed Yam (₦)	26.26	50.24	45.08
Fixed Input (₦)	4075.58	404.44	1980.68
Fertilizer (kg)	22.00	225.00	359.76
Other Variable Inputs (₦)	23,797.55	6,207.20	1.72

Demand for Seed Yam

Result of the parameter estimates in the linear regression analysis is shown in Table 2. Value of seed yams demanded in naira was used as the dependent variable (Y), and the independent variables were as shown in the Table. The adjusted coefficients of determination were 53to 77%, indicating that variation in the explanatory variables accounted for about 53 to 77% of variation in value of seed yam demanded in Northern Nigeria. The F-ratio was statistically significant at the 1.0 per cent level of probability for all the States, indicating that the model specifications were correct and thus results can be used for policy recommendation.

The coefficients of own price for seed yam (P) were negative and significant in Benue and Abuja. This result generally conforms to *a priori* expectation as price increases are expected to lead to reduction in quantities demanded of normal goods. Thus, farmers will demand for additional seed yams only when the price is low otherwise they make do with reserves from last years' harvest.

Influence of Socio economic variables on Seed Yam demand

The results of the analyses also suggest that age exerts a positive and significant effect on seed yam demand by household heads in Abuja Territory. Thus, the elderly here are more engaged in seed yam production. Farm size was significant and positive for Nasarawa and Abuja except Benue where the relationship is negative. This implies that higher farm sizes urge farmers to demand for more seed yam in the two States. Benue farmers generate enough seed yams for own production. Availability of fertilizer encourages demand for seed yams by farmers in Benue and Nasarawa States.

Table 2. Demand Functions for Seed Yam in Northern Nigeria

Variable	Benue	Abuja	Nasarawa
Constant	-55136.44	-26193.51	-14012.07
	(-0.724)	(-1.639)	(-1.114)
Age of House Hold Head (age)	617.024	1033.179**	282.774
	(0.428)	(2.097)	(0.628)
Educational Level (edn)	106.741	2028.503**	935.626**
	(0.038)	(2.369)	(2.073)
Disposable Income (I)	0.231**	-9.890E-06	2.915E-02**
	(2.499)	(-0.002)	(2.093)
Labour Availability (L)	1163.527***	59.753***	-56.380*
	(3.106)	(4.973)	(-1.929)
Farm Size (Fs)	-191294.3**	3487.766***	15982.92***
	(-2.081)	(7.382)	(3.822)
Experience (Exp)	-138.588	-1186.110**	-449.689
	(-0.101	(-2.212)	(-0.998)
Price of Substitute (Ps)	242.417	111.318*	-11.323
	(1.046)	(1.737)	(0.483)
Price of Seed Yams (P)	-162.970	-56.409	64.891
	(-0.231)	(-1.458)	(0.855)
Fertilizer in kg (Fertkg)	194.745*	20.276	17.160**
	(1.885)	(0.681)	(2.394)
Variable Imputs (Vi)	-0.908	-0.102	-1064.374
	(-0.430)	(-1.297)	(-1.089)
R^2	0.622	0.821	0.792
Adjusted R^2	0.525	0.768	0.701
F-values	6.407***	15.574***	8.750***

Source: Derived from survey data, 2006.
Note: *, ** and *** = Significant at 10%, 5% and 1% respectively
Values in parenthesis are the t-values.

Education was positive and significant for Abuja and Nasarawa States, indicating that increases in educational level will bring about increases in seed yam demand in these States.
In Benue and Nasarawa States, the coefficients of income were positive and significant at the 5% level, implying that increase in income in these states will bring about increase in seed yam demand.
Availability of labour was found to be a positive and significant determinant of seed yam demanded at the 1 percent level for Benue and Abuja. For Nasarawa, it was only significant at the 10 percent level. These imply that increases in labour availability will bring about increases in seed yam demand in these states.
The elasticity of demand for seed yams with respect to farm size was positive and elastic for Nasarawa state but inelastic for Abuja (Table 3.). This implies that increase in farm size will bring about a more than proportionate

increase in seed yam demand in Nasarawa State and a less than proportionate increase in Abuja.
The elasticities with respect to education for the two States were 0.6 and 0.28 respectively. This implies that increases in the educational level of respondents will bring about a less than proportionate increase in quantity of seed yam demanded in the States.

Table 3. Estimated Price Elasticities of Explanatory Variables on Demand for Seed Yams

Variables	Abuja	Benue	Nasarawa
Age	2.4	0.60	0.58
Education	0.60	0.01	0.28
Labour	0.55	3.00	-0.64
Farm Size	0.75	-3.10	1.51
Experience	-1.70	0.10	-0.49
Fertilizer(kg)	-0.02	0.00	0.31
Variable Inputs (VI)	-0.11	0.10	-0.09
Total	2.47	0.7 1	1.46

Source: Derived from survey data, 2006

The elasticity with respect to labour in Benue was 3.0 implying that increases in labour availability will bring about a more than proportionate increase in seed yam demand. This conforms to expectation because closer examination of respondents revealed that Yam mounds in Benue State are usually prepared in the month of November and left to be planted up by February which takes advantage of cheap labour and ensures that large area is prepared before planting starts.

For Abuja and Nasarawa States, the elasticities with respect to labour were 0.55 and -0.64 respectively implying that demand for seed yams is inelastic for the States, but elastic for Benue. This implies that increases in labour availability will bring about a less than proportionate increase in seed yam demand in Abuja; but a less than proportionate decrease in demand in Nasarawa.

Price elasticities
Table 4 presents the respective computed own price, cross price and income elasticities of demand for seed yam. In accordance with utility theory, the own-price elasticities are negative for Abuja and Benue States. Demand is price inelastic for the States of Abuja and Benue with respect to their own prices. Own-price elasticities ranged from -0.069 for Abuja and -0.141 for Benue. The positive own price elasticities of demand for seed yams in Nasarawa may either be accounted for by the fact that there is not much variability in the price of seed yams in the State.

The cross price elasticities for seed yams with respect to the price of major substitutes are positive except for Nasarawa State, indicating that the products are substitutes and demand is inelastic, indicating that increases in the price of seed yam will bring about less than proportionate increase in the demand for the substitutes such as cassava and cocoyam. There was an elastic cross price for Benue indicating that increases in price of seed yam will result in more than proportionate increase in substitute demanded. The substitutes in Benue include cassava and cocoyam.

Influence of Socio economic variables on Seed Yam demand

The income elasticities of demand for seed yams are all positive but less than one suggesting that seed yams in these states are normal goods whose demand will increase with increasing total disposable income on seed yams. Income elasticities of demand for seed yams in Northern part of the country are less than unity in the States studied. This indicates that demand for seed yams is inelastic with respect to income. The income elasticities were found to be 0.54 and 0.17 for Benue and Nasarawa respectively. This implies that a 1.0% increase in income will bring about less than proportionate increase in quantity of seed yams demanded.

Table 4. Own Price, Cross Price and Income Elasticities of Seed yam Demand.

Elasticity	Abuja	Nasarawa	Benue
Own price	-0.069	0.149	-0.141
Cross price	0.925	-0.103	107.9
Income	1.29E-4	0.172	0.54

Source: derived from survey data, 2006.

CONCLUSION

The study indicated that seed yam farmers in Northern Nigeria are averagely aged with low level of literacy. Farmer's only sell seed yams after satisfying own requirements. Relevant variables influencing demand for seed yams in Northern Nigeria include farm size, level of education and the disposable income of the farmers. Others are experience in seed yam production and labour availability. These results call for policies aimed at encouraging farmers for increased cultivation of seed yams, improving farmers' access to inputs such as fertilizer and other inputs. Thus, for the commercialisation of the seed yam sector, farmers should be educated especially through extension services on the benefit of seed yam enterprise.

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REFERENCES:

Adepoju, S.O. (2006), An Analysis of Industrial Demand for Maize in Three Selected States of Nigeria using Almost Ideal Demand System (AIDS) Proc. Of 2006 Nigerian Assoc. of Agric. Economists (NAAE) Conf. Ladoke Akintola Univ. of Technology, Ogbomoso, 27-30 Nov. Pp 62-69.

Asumugha, G. N., B. O. Ugwu, , O. C. Aniedu , G. C. Orkwor and K. Amegbeto (2007), Minisett technique of seed yam production in two major yam producing states of Nigeria: a function of input availability and production objective. In :N.M. Mahungu and V.M. Manyong (eds.) Advances in Root & Tuber Crops technologies for sustainable food security, improved nutrition, wealth creation & environmental conservation in Africa. Proceedings of the 9th Triennial Symposium of the International Society for Tropical Root Crops African Branch (ISTRC-AB), Mombasa, Kenya, 1 5 November, 2004. Pp 209-214.

Asumugha, G.N., O.C. Aniedu, M.C. Ogbonna, B.C. Okoye, O.A. Akinpelu, H.N. Anyaegbunam, J.E.G. Ikeorgu, G.C. Orkwor, K.I. Nwosu and M.C. Okwusi (2007)

'Compative economic analysis of seed yam production techniques in Nigeria" The *Nigeria Agricultural Jounal*, 38: 92-99.

Deaton, A.S., & Muellbauer, J. (1980b). An Almost Ideal Demand System. American Economic Review, 70: 312-326.

Effiong, E. O. and M. E. Njoku (2001), Empirical Estimation of Demand Functions and Elasticities for Goat Meat product in Cross River State, Nigeria. *Journal of Sustainable Agriculture and the Environment*, 3(1): 2001.

FAO (2006): Food and Agricultural Organization (2006) Databases

Jumah, A., A.O. Dipeolu, I.A.Ayinde, K. Adebayo, O.B. Oyewole and L.O. Sanni (2004), "The Demand for processed cassava food products in Lagos" In :N.M. Mahungu and V.M. Manyong (eds.) Advances in Root & Tuber Crops technologies for sustainable food security, improved nutrition, wealth creation & environmental conservation in Africa. Proceedings of the 9th Triennial Symposium of the International Society for Tropical Root Crops African Branch (ISTRC-AB), Mombasa, Kenya, 1 5 November, 2004. Pp 304-308.

Koutsoyiannis, A. (1979): Modern Micro Economics, Macmillan Education Limited 2nd Edition, London.

Kushwaha. S. and I. M. Polycarp (2001), Economics of small scale yam production in Qua'an Pau LGA of Plateau. In: Abubakar M.M., Adegbola, T.A. and Butswat, I.S.R. (Eds), The Role of Agriculture in Poverty Alleviation. Proc. 34th Ann. Conf. of Agric. Soc. of Nigeria, held at Abubakar Tafawa Balewa University (ATBU), Bauchi, Oct., 15 19, 2001, pp 69 74.

NRCRI (2004); Yam: Science and Technology Briefing, 20 22nd February, 16p, National Root Crops Research Institute, Umudike and National Stored products Research Institute, Lagos.

Nweke, F. I., B. O. Ugwu, C. L. A. Asadu and P. Ay (1991), Production costs in the yam-based cropping systems of southeastern Nigeria. Resource and Crops Management Program Research Monograph No. 6, 11TA Ibadan, Nigeria.

Okoli, O. O. and M. O. Akoroda (1995), Providing seed tubers for the production of food yams. African Journal of Root and Tuber crops 1(1): 1-6.

Ugwu, B. O. (1990), Resource use and Productivity in food crop production in major yam producing areas of south-eastern Nigeria. Ph. D. dissertation, University of Nigeria, Nsukka.