Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 13, Issue 4, 2013
PRINT ISSN 2284-7995, E-ISSN 2285-3952

BREADFRUIT (*Treculia africana*) MARKETING ACTIVITIES AND RETURNS IN AHIAZU MBAISE LOCAL GOVERNMENT AREA, OF IMO STATE, NIGERIA

Ogbonna Christopher EMEROLE, Chidozie Onyedikachi ANYIRO, Charles Kelechi OSONDU, Nwachukwu N. ANDERSON, Chukwu F.NGOZI

Abia State University, Department of Agricultural Economics and Extension, Umuahia, P.M.B 7010, UTURU, +234 803 6811 454, +234 805 2610 681, Abia State, Nigeria. Emails: emerolechriso@yahoo.co.uk, anyirochidozie@gmail.com,

Corresponding author: emerolechriso@yahoo.co.uk

Abstract

This study on marketing of breadfruits (Treculia africana) and returns was done in Ahiazu Mbaise local Government area of Imo State, Nigeria. The specific objectives of the study were to describe socio-economic characteristics of respondents (sellers and buyers) of African breadfruit; identify value-chain activities available in processing and its storage in compliance with consumers' order and preferences; determine factors influencing decision to supply African breadfruit; and constraints with its post-harvest management in the study area. Three-stage random sampling technique was used in selecting locations and respondents through which eighty (80) farm households who gather/harvest, process and sell breadfruits were selected and interviewed with structured questionnaire. Data collected were analyzed using descriptive statistics, and probit regression model. Result revealed that 65.80% of the respondents were females and 81.20% of them were married with mean household size of 9 members. Their literacy level was high as 97.6% of them had at least primary education. Predominant marketing activities were fruit gathering/harvesting, processing, storage and packaging, transportation, and sales. Socio-economic factors of gender, household size, income, level of education, years of farming experience and labour significantly influenced supply of breadfruits to consumers with challenges of seasonal scarcity, and tedious methods of processing deterring the enterprise in the area. We recommended provision of credit support to enable fruit gatherers purchase and use shelling machines and good storage facilities to smooth any fluctuations in supplies during off-seasons and help fight overdependence of households on roots and tubers.

Key words**:** *Ahiazu Mbaise, breadfruit, marketing, value chain activities*

INTRODUCTION

Breadfruit is important food tree crop that bear seeds widely eaten in southern Nigeria. It has a potential of providing palatable cooking oil. Literature has revealed that on commercial scale of vegetable oil production breadfruit can yield 10.23% of oil (Ekpenyong, 1980; Okeke, 2005; Nwigbo et al., 2008). The trees bear fruits that vary in size but are generally spherical, large, rough textured, green when juvenile and greenish-yellow when ripe, pulpy and covered with soft, spinous structure (Baiyeri and Mbah, 2006). Gathering of ripe fruits from the wild and harvested ones from orchards of farm households is a common farm activity during heavy fruiting period (February to August) and period of light fruiting (September to January) in parts of southeastern Nigeria (Okafor, 1985). At present, cultivation, gathering and processing of African breadfruit in the area provides a chain of subsistence agricultural activity which still is relatively non-mechanized but provides rural jobs, especially for the women.

Breadfruit is a traditional food; the consumption is culturally accepted and is gradually being changed from food for the poor to food for the affluent in the area and in all Igbo ethnic communities. Okeke et al. (2008) confirmed its choice by the rich and the sick by describing it as an expensive delicacy eaten alone boiled or eaten with other foods, and could be roasted and eaten with palm kernel or coconut as a snack. Further, they saw it as a good source of income with good nutrient value for diabetics. Fassi et al.

(2004) and Nwabueze (2006) also recognized African breadfruit seeds as good snack food, the flour of which is used in thickening soup and baking cakes. Nutritionally, Ejiofor and Okafor (1997) analyzed the food content of African breadfruit and revealed that it contains protein 14.6%, carbohydrate 68.08%, fat and oil 11.3%, with varying percentages of vitamins, crude fibre, mineral salts and water. Gaimi et al. (2000) recognized breadfruit seeds as good supplements to livestock feeds as well as good food for humans.

One personal communication by Nigeria Institute of Horticulture (NIHORT) in 2008, reported the high price fetch by African breadfruit by stating that 3.80 kg of the seed sells for as much as seven hundred and fifty naira (₦750.00) (4.69 US$) 1US$ = ₦ 160. This means that trading on breadfruits can not only provide employment for persons who engage in it but could fetch a reliable income to persons who find it difficult to gain employment in conventional industries. This use of non-timber products to fetch household support employment and income had been emphasized in Nigeria (Adepoju and Salau, 2007; Babalola and Agbeja, 2010). Encouraging fruit tree growers and gatherers, Nzekwe et al. (2010) observed that planting a hectare with 100 stands of breadfruit will fetch an annual income of eight hundred and eleven thousand, three hundred and forty naira(5070.875 US$).

Breadfruit head or bunch are hard and fibrous, weighing about 8.70kg and enclose between 50 and 70 seeds, with trees planted some distance away from residential areas to avert danger posed by the large heavy fruits which traditionally are not harvested but are allowed to ripen and drop from the tree (Mbakwe, 2005). Fallen breadfruit heads are gathered in heaps, allowed to rot/ferment for about seven days and washed with fresh water to extract the unshelled seeds.

Breadfruit marketing activities include all postharvest activities involved in the flow of breadfruits and seeds from the field to consumers through available different marketing channels. These activities according to Burt and Wolfley (2009) include gathering, processing, storage and packaging, transportation, marketing and administration. They all involve use of labour, materials and equipment/implements. The activities are thus associated with its preparation for use and need to be made dynamic. They are crucial value-chain activities needed for securing and protecting rural employment and help in slowing down exodus of rural folk (especially women) from countryside to the towns, which has accelerated in recent decades. Hence, the specific objectives of the study were to:

((i)describe socio-economic characteristics of respondents (sellers and buyers) of African breadfruits;

(ii)identify and explain value-chain activities available in processing and storage of African breadfruits in compliance with consumers' order and preferences;

(iii)estimate annual net income (profit) from breadfruit sales by farmers/gatherers and traders in the study area;

(iv)determine factors influencing decision to supply African breadfruits to traders; and

(v)determine challenges with its gathering, processing and sales in the study area.

MATERIALS AND METHODS

This study was conducted in Ahiazu Mbaise Local Government Area (LGA) of Imo State, Nigeria. Ahiazu Mbaise is made up of two clans-Ahiara and Ekwereazu. The area is at the heart of Imo State bounded by other LGAs: Ehime Mbano in the North, Aboh Mbaise in the South, Obowo in the East, and Ikeduru in the West. Ahiazu lies within latitudes 5°02' N and 7°17'N of the Equator and longitudes 13°10' E and 14°15' E of the Greenwich Meridian. Ahiazu is a densely populated area with a density of over 1,000 persons per square kilometer. Nigeria 2006 population census enumerated Ahiazu Mbaise as the fourth largest LGA in Imo State with a population of 170,902 inhabitants made up of 88,440 males and 82,426 females (NBS, 2006).

The inhabitants are mainly farmers growing food crops such as cassava (*Manihot esculenta*), maize (Zea mays), yam

(*Dioscorea* sp.), plantain (*Musa paradisiaca*), bananas (*Musa sapientum L*), cocoyam (*Colocasia esculenta and Xanthosoma mafafa*), cowpea (Vigna unguiculata), pepper (Capsicum spp), African oil beans (Phaseolus and Vigna spp), yam bean (Psaseolus vulgaris), fruits and vegetables such as orange (Citrus sinensis), guava (Psidium guajava), Cucumber (Cucumis sativus), Pumpkin (Cucurbita spp) . African breadfruit tree grows freely in the many natural and secondary forests of Ahiazu Mbaise where the land use system is predominantly tree-crop alley farming. In some of the secondary forests, the African breadfruit grows naturally with the African Oil bean trees or amidst one major cash crop grown in the area, the oil Palm. Road network in the area is typically rural with some farm households located as far as 15-20 km from the main road leading to Owerri town, the state capital. Breadfruit trees are equally cultivated or the ripped fruits freely gathered for food and for sale by most farm household in the area.

Three-stage random sampling technique and purposive sampling technique were used in selecting location and respondents. The first of the three-stage sampling technique involved selecting randomly four out of the twenty-seven autonomous communities in Ahiazu. The selected communities were Ihitte-aforukwu, Nnarambia, Ogbe, and Umuokirika. Three community markets serving them, namely Afor-Ukwu, Afor Ogbe, and Nkwoala were equally chosen. In the second stage, two villages were randomly selected from each chosen community, giving a total of eight villages. In the third stage, ten farm households were chosen at random from each selected village giving a total of eighty (80) breadfruit farmers/gatherers involved in this study. Purposive sampling method was used in selecting breadfruit traders from the chosen markets in the area. Seven breadfruit traders were thus selected from each of the three selected markets in the area to give a sub-sample of twenty one traders involved in this study. Thus a total of 101 respondents consisting of 80 breadfruit farmers/gatherers and 21 breadfruit traders were involved in this study. Primary data were collected from the respondents using two structured questionnaires, one administered to the chosen farm households and the other to traders who buy and sell breadfruit heads or bunch, shelled and unshelled seeds in the area. Data gathered were analyzed descriptively and inferentially.

Descriptively, data were analyzed using SPSS version 16.0 to compute means, frequency distribution was used in describing socio-economic characteristics of breadfruit farm households/gatherers and traders. The returns from breadfruit enterprise to the households and traders were determined using farm budget analysis. Net marketing income was computed by subtracting marketing costs from gross sold breadfruit value. Computing net income was possible when we estimated the fixed costs incurred in marketing. The fixed marketing costs identified on the side of farmers/fruit gatherers included: depreciation costs on baskets used in washing/filtering, pots used in parboiling seeds, spoons, mats used for seed drying, depreciation charge on marketing stalls, interest on investment capital (average investment, i.e., initial investment plus estimated salvage value divided by 2 x interest rate), and jute bags used for storage and transportation. The variable costs identified included hired labour charges for gathering/harvesting breadfruits, hired labour charges for fruits processing, cost of firewood used, interest on operating capital (one third of variable costs x interest rate), transportation expenses, cost of packaging materials, and cost of repairs of machines/implements. Mathematically, the Net Farm Income (NFI) was determined with:

$NFI = \sum P_i Y_i - \sum P_{xi} X_j - \sum Z_k \ldots$ (1)

where:

NFI = Net Farm income for African breadfruit marketing;

Y_i = Quantity of breadfruit gathered/harvested by ith farmer in a year (tons) i = 1, 2, 3…n;

P_i = Price per ton of breadfruit gathered/harvested (US$ …..;₦'000);

X_j = Quantity of jth variable cost item incurred in marketing breadfruit (j= 1, 2, 3, …m);

P_{xi} = Unit price of the jth variable cost item (US$ ….=Naira);
Z_k = The cost of k^{th} fixed cost item in marketing of breadfruit (k = 1, 2, 3,...,k);
$\sum$ = Summation sign.

The depreciation cost of all fixed marketing items was determined following straight line method with assumed scrap value of zero naira after three years. Thus:

$$\text{Annual depreciation} = \frac{\text{Current Value of breadfruit Marketing Fixed cost item}}{\text{Expected lifespan of breadfruit Marketing fixed cost item}} \quad \ldots(2)$$

The probit regression model was used because decision to supply breadfruits varied from one household to another and among exposable factors suggesting gathering/harvesting breadfruits in excess of household consumption needs with some level of chance or probability. To determine factors that influenced decision of households to supply breadfruits to buyers, a probit model was considered most appropriate. This model was stated as follows:

$$Y_{ij} = \alpha_j + \beta_j \sum_{k=1}^{s} H_{ijs} + \varepsilon_{ij} \quad \ldots(3)$$

wherethe H_{ijs} are vectors of s explanatory variables of the j^{th} household supplying breadfruit; Y_{ij} is a vector of binary variables such that Y_{ij}=1 if the j^{th} household brings breadfruits in excess of her needs for sale, and 0 otherwise. Since Y_{ij}can only assume two different values for the decision yes or no, represented by 1 or 0, the expected probability can be defined as follows:

$$E(Y_{ij}) = E\left[\alpha_j + \beta j \sum_{k=1}^{s} H_{ijs} + \varepsilon_{ij}\right]$$

$$= \alpha_j + \beta_j \sum_{k=1}^{s} H_{ij} E(H_{ij}) \quad \ldots(4)$$

Equation (4) defines the proportion of households with characteristics (H_{ij}) likely to supply processed breadfruits for buyers to buy. The empirical model was specified thus:

$$EXP\ Y_{ij} = \beta_0 + \beta_1 \ln(AG_{ij}) + \beta 2 \ln(GN_{ij}) + \beta 3 \ln(MS_{ij}) + \beta 4 \ln(HS_{ij}) + \beta 5 \ln(ED_{ij}) + \beta 6 \ln(HL_{ij}) + \beta 7 \ln(IC_{ij}) + \beta 8 \ln(ME_{ij}) + \beta 9 \ln(EP_{ij}) + \varepsilon_{ij} \quad \ldots (5)$$

Where variables are as defined in Table 1. The dependent variable is household's decision to supply breadfruit to buyers as defined in equation (1). The explanatory variables were both the continuous and binary types. It was hypothesized that household's supplying breadfruit would positively be affected by: MSij; HLij; ICij; MEij; and EPij; but would negatively be affected by: HSij; EDij; AGij; and GNij.

Table 1. Description of Probit Analyzed Variables

Variable	Type	Description
EXP Yij	Binary	1 if the jth household processed and sales breadfruit; 0 otherwise
AGij	Continuous	Continuous: Age of household head (years);
GNij	Binary	Gender of household head (Male=1; Female=0);
MSij	Binary	1 if head of household is married; 0 otherwise;
HSij	Continuous	Household size (number of persons living and feeding from same pot);
EDij	Continuous	Number of years of formal education;
HLij	Binary	1 if the household processes breadfruit with hired labour; 0 otherwise;
ICij	Continuous	Monthly household income (₦'000);
MEij	Continuous	Monthly household Consumption Expenditure (₦'000);
Epij	Continuous	Years of farming experience.

RESULTS AND DISCUSSIONS

The socioeconomic characteristics of sampled 80 breadfruit gathering/processing households in Mbaise Imo State are as summarized in Table 2. The Table revealed that majority of the breadfruit processing and selling farm

households (90.0%) were aged between 30 and 60 years, suggesting that breadfruit processing and selling was an enterprise that demanded commitment in management which was provided mainly by able-bodied individuals within the workforce age bracket. Relatively few young adults (7.5%) were engaged in breadfruit gathering/farming and processing with still fewer elders (2.5%) managing their retirement from active workforce remaining in the enterprise.

Table 2. Socioeconomics of breadfruit gatherers/farmers and traders in AhiazuMbaise, Nigeria. 2012.

Breadfruit Gatherers/Farmers (n=80)					Breadfruit Traders (n=21)		
Variable	Number	Mean of continuous variable.	Percent (%)		Number	Mean of continuous variable.	Percent (%)
Age (yrs)							
< 30	6	19.0	7.5		3	17.8	14.3
30–60	72	51.0	90.0		14	49.2	66.7
> 60	2	62.1	2.5		4	63.1	19.0
Gender							
Male	27		33.7		2		9.5
Female	53		66.3		19		90.5
Marital Status							
Single	15		18.8		1		4.8
Married	65		51.2		20		95.2
Household Size (Number)							
1– 5	71	4.6	88.8		12	4.1	57.1
6– 10	7	8.2	8.8		7	7.3	33.3
>10	2	16.0	2.5		2	13.0	9.5
Education level							
No formal Educ	2		2.5		2		9.5
Primary Educ.	9		11.3		11		52.4
Secondary Educ	39		48.8		8		38.1
Tertiary Educ.	30		37.5		nil		0.0
Annual labour Used (man days)							
Household only	33	185.0	41.3		21	208.0	100.0
Hired	20	210.5	25.0		nil		nil
Household/Hired	27	177.1	33.8		nil		nil

Source: Field Survey, 2013

There was twice the proportion of males as there were females in breadfruit gathering and processing enterprise in the study area.
Dominance of women (66.3%) as against 33.7% males, suggests that harvesting and/or gathering and processing of African breadfruit are time consuming activities that require expertise, skill and innate physical exertion of carefully selected force (Nwigbo, 2008). Mostly married individuals (51.2%) were involved in the enterprise using labour provided from within their households and/or hired from outside. A large proportion of the households (88.8%) had at most five members which could be adjudged moderate and may justify decisions to hire labour to augment

household labour in processing of breadfruits. An estimate of hired labour is vital in making reliable budget for financial returns. Table 2 further revealed that 41.3% of the farm households provided an average of 185 man days used in breadfruit gathering and processing activities, with 25.0% and 38.8% of farm households using hired labour and household/hired labour using up 210.5 and 177.7 man days respectively for these purpose annually in Mbaise, Imo state. Their literacy level was quite good as 96.6% of the heads of breadfruit farmers/gatherers households/decision makers had at least primary education. These indices have implications in farm decision-making in use of resources, supply of products and technology adoption (Obibuaku, 1983; Ojoko, 2001; and Olaitan, 1984). The breadfruit traders who buy and sell this product in the local markets were both young and aged, mainly females (90.5%), who are married (95.2%), with high proportion (90.5%) having at least primary education. In buying and selling the breadfruits, they all (100.0%) made use of household labour.

Value-chain activities available in processing and storage of African breadfruits

Many products from micro and small enterprises, including those of self-employed small-scale farmers are strengthened by improving the range of activities that bring their products or service from points of conception to their end users. Gathering of breadfruits, its processing, storage, transportation, and marketing help to add value at each stage of these marketing activities. These activities are shown in Fig. 1.

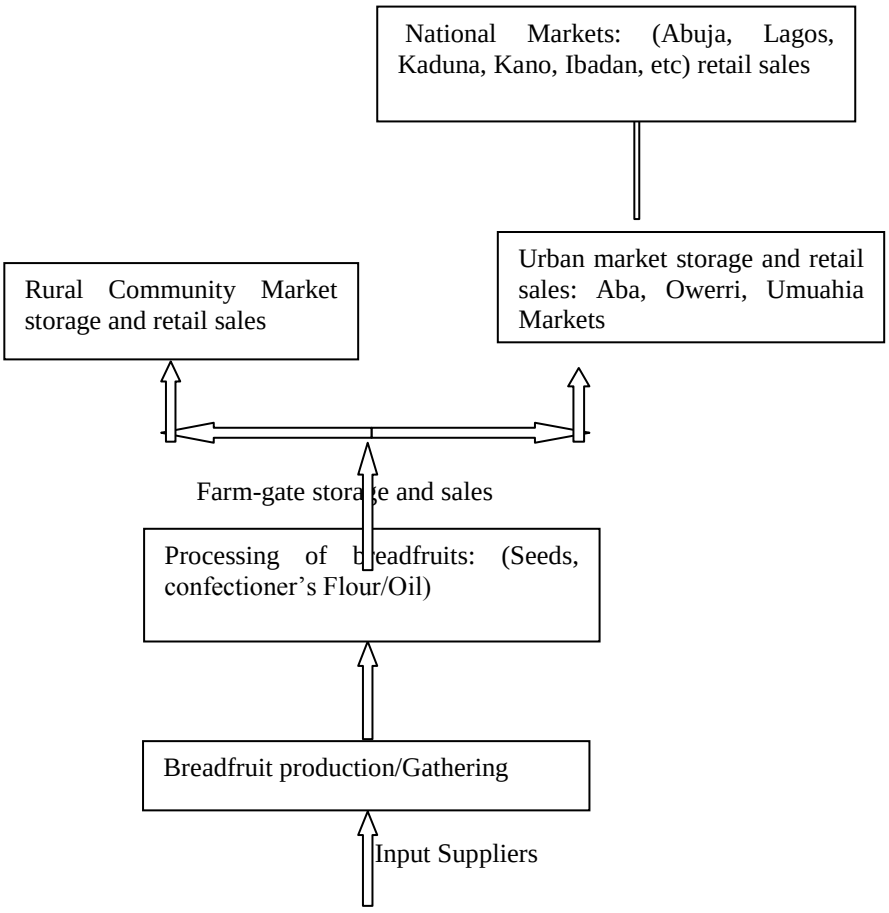

Fig. 1. Breadfruit supply flow and value-adding activities in Mbaise, Nigeria.

Breadfruit processing involves placing harvested or agro-forest gathered breadfruits in heaps for 2-3 weeks until they ferment so well to allow for extraction of the seeds as

described by Baiyeri and Mbah (2006). The extracted seeds are sun-dried for 2 hours and packed off in airy baskets until they are ready for farm-gate sales. Farm-gate and other sales in the various markets are done with disused paint small plastic buckets which when full accommodates 3.8kg weight of unshelled seeds. Each of such buckets full of unshelled breadfruits sold for between ₦700.0and ₦900.0 (4.38 and 5.63US$)amongst the farmers. The unshelled seeds could be roasted and/or shelled for consumers who need breadfruits eaten with cracked palm kernels as snacks or parboiled, and dried for further processing. By traditional method, the dried unshelled seeds are carefully and repeatedly rolled over with smooth empty beer bottle to scratch the brown coloured breadfruit seed coats.

Table 3. Summary of annual marketed quantities, costs and returns from breadfruit seeds in Ahiazu Mbaise, Nigeria. 2012.

S/N	Description	Farmers/Gatherers (Sellers) (n=80) Total		Traders (Buyers)(n=21) Total	
1.	Quantity of breadfruit seed processed/purchased (Tons)	48.4		51.5	
2.	Average Sales price per ton (₦)	236,842.1		315,789.5	
3.	Minimum Sales price per ton (₦)	236,500.0		315,789.5	
	Variable Costs(VC) (₦)		**Percentage of Cost**		**Percentage of Cost**
4.	Hired fruit Gathering labour	264,123.0	35.8	Nil	0.0
5.	Transportation	86,216.4	11.7	215,211.2	63.4
6.	Hired fruit Processing labour	256,274.3	34.7	Nil	0.0
7.	Firewood	50,427.5	6.8	Nil	0.0
8.	Seed Packaging materials	23,167.2	3.1	89,321.5	26.3
9.	Maintenance/Repairs	20,564.0	2.8	17,468.2	5.2
10.	Interest on Operating Capital §	37,374.5	5.1	17,173.4	5.1
11.	**Total Variable Costs (TVC)**	**738,146.9**	**100.0**	**339,174.3**	**100.0**
	Fixed Costs (FC) (₦) Depreciated over three years				
12.	Wheel barrows	150,000.0	20.8	105,000.0	20.7
13.	Baskets	30,135.5	4.2	73,294.3	14.5
14.	Basins	90,213.4	12.5	48,324.2	9.5
15.	Jute/Polythene bags/storage	42,162.2	5.8	98,352.7	19.4
16.	Mats	28,341.1	3.9	12,143.3	2.4
17.	Shelling Machines/Implements	111,500.5	15.4	Nil	0.0
18.	Boiling pots	82,247.4	11.4	Nil	0.0
19.	Steering/sieving Spoons	25,211.3	3.5	Nil	0.0
20.	Marketing Stalls	120,356.7	16.7	139,453.6	27.6
21	Interest on Investment Capital §	42,413.4	5.8	29,725.4	5.9
22.	**Total Fixed Costs (TFC)**	**722,581.5**	**100.0**	**506,293.5**	**100.0**
23.	**Total Costs: (TFC) + (TVC)**	**1,460,728.4**		**845,467.8**	
24.	Revenue (₦) (1)x(2)	11,463,157.0		16,263,159.0	
25.	Gross margin (24) – (11)	10,725,011.0		15,923,984.7	
26.	Mean Gross margin (25)/n	134,062.6		758,284.9	
27.	Net Return (Profit) (25) – (22)	10,002,429.5		15,417,691.2	
28.	Mean Net Profit (27)/n	125,030.4		734,175.8	
29.	Producers' Surplus (2) –(3)	342.1			
30.	Return Per Naira invested in Bredfruit Marketing (27)/(23)	6.8		18.2	

§ Mean interest rate for agriculture and petty trading loans =16.0%; 1.0 US$ = 160.0 NGN, Source: Field Survey, 2013

The so bruised seeds are squeezed to free white seeds from the chaff. Alternatively, a shelling machine with two rollers (one adjustable and the other rotating) is used to bruise the seeds. The freed brown coats of the seeds are pneumatically blown off to leave free the white seeds. The white seeds are now dried further to a moisture content level that prevents growth of molds, thus enabling seeds store for about six months. Storage is done in dry jute/polythene bags at room temperature or in refrigerators.

Estimation of Returns from Breadfruit Sales

Table 3 is a summary of annual costs and returns from breadfruit marketing by sellers and buyers in Ahiazu Mbaise of Nigeria. One disused paint small bucket full (3.8kg equivalent) of shelled clean breadfruit seed sold for between ₦1, 200.0 and ₦1, 400.00 (7.7 and 8.75 US$) depending on the market (farm gate, rural, urban or national market). On the average, each tonne of shelled breadfruit sold for ₦236, 842.1(1480.26 US$) at the farm gate and sold for ₦315, 789.5 (1973.68 US$) by traders in the local markets as shown in Table 3.0. The mean annual quantity of breadfruit processed by farmers was 48.4 tons and mean annual breadfruit sold by traders in the local markets was 51.5 tons. Labour hired and used for gathering ripe breadfruits (₦264, 123.0)(1650.8 US$) accounted for 35.8% of the variable cost of the farmers, hired labour used for processing the fruits (₦256, 274.3) (1601.71 US$) accounted for 34.7% of the variable costs and transportation (₦215,211.2) (1345.07 US$)accounted for 63.4% of the variable costs incurred by the traders with seed packaging material accounting for 26.3% of the variable costs incurred by traders of breadfruit and were the most outstanding variable cost items in bread fruit marketing.

The low variable cost items in marketing of breadfruits were maintenance/repair of trading assets (5.2%), interest on operating capital for farmers and traders (5.1% each) as well as packaging materials used by farmers (3.1%). Depreciation of marketing stalls (₦139, 453.6) (871.59 US$) accounted for 27.6% and (₦120, 356.7) (752.23 US$) accounted for 16.7% of the fixed costs items for breadfruit traders and farmers respectively; and wheel barrows (₦150,000.0) (937.50 US$)accounted for 20.8% of the fixed costs to farmers and (₦105,000.0) (656.25 US$)or 20.7% of the fixed cost items to the traders. Another fixed cost item that was high was shelling machines/implements that accounted for ₦111, 500.5 (696.88 US$) or 15.4% of the fixed costs to the farmers. The low fixed cost items to the farmers included interest on investment capital (5.8%), depreciation of Jute/Polythene bags used in storage (5.8%), depreciation of baskets (4.2%), steering/sieving spoons (3.5%) and mats (3.9%) used in drying the seeds. Amongst the traders, items that accounted for the low fixed costs were depreciation of mats (2.4%), interest on investment capital (5.9%) and depreciation of basins (9.5%).

Returns from breadfruit marketing to farmers and traders were quite high and encouraging to the enterprise. The estimated mean annual Gross Margin was ₦134, 062.6 (837.89 US$) to farmers and ₦758, 285.0 (4739.28 US$) to traders. The estimated mean annual net profits were ₦125, 030.4 (781.44 US$) to the farmers and ₦734, 175.8 (4588.60 US$) to the traders. Each naira invested in breadfruit marketing yielded ₦6.80k (0.04 US$) to the farmers and N18.20k (0.11 US$) to the traders in the area. This high return per naira invested suggests that overhead cost in breadfruit marketing was low with traders and consumers displaying preference and willingness to pay for the product (De Groote *et. al.*, 2011). Producers' (Sellers') Surplus or the difference between the price sellers received (₦236, 842.1/ton) (1480.26 US$/ton) for shelled breadfruit and the minimum or lowest price (₦236, 500.0/ton) (1478.13 US$/ton) for which they would have sold the commodity was ₦342.1(2.13 US$) showing it was attractive to produce or gather breadfruits for sale in the area.

Determinants of decision to supply African breadfruit to traders

Supply decisions are made by producers and traders along distributive channel of a

product. The decision to supply or not to supply a product as made by a producer is however, more overriding. Factors influencing decisions to supply breadfruit by farmers/gatherers of breadfruit in Ahiazu Mbaise was estimated with Maximum likelihood probit regression model and estimates shown in Table 4.

The table showed that two factors, level of education attainment and monthly household income most highly and positively determined decision to supply breadfruits in domestic Ahiazu markets of Nigeria.

This means that the highly educated farmers/ breadfruit gatherers earning relatively high monthly farm income took positive decisions of supplying more breadfruits to buyers in domestic Ahiazu markets of Nigeria.

Other important determinants of decisions to supply breadfruit in the study area were gender, hired labour and farming experience. Women farmers gathered, processed and supplied more breadfruits than did the males. They did this with both hired and household labour but those with many years of farming experience that used hired labour took positive decisions and supplied more breadfruits in the local markets.

Table 4. Maximum likelihood of first-stage Probit estimates of factors influencing farmers decision to supply African breadfruit in Ahiazu Mbaise markets, Nigeria. 2012.

Variables	**Coefficient**	**Standard Error**	**t-ratio**
Constant	-2.212**	1.083	-2.042
Age of household head	0.034	0.043	0.788
Gender	3.106**	1.562	1.988
Marital status	-0.06	2.143	-0.028
Household size	2.516*	1.005	2.145
Educational level	6.414***	2.356	2.722
Hired fruit gathering/processing labour	9.123*	2.063	4.422
Monthly household income	5.286***	1.379	3.833
Monthly household consumption expense	-0.040	0.120	-0.333
Years of farming experience	4.048*	3.090	1.310
Likelihood Ratio test	86..4***		-
R-Squared	0.734***		-

Source: Field Survey, 2013. *, **, and *** Significant at alpha levels of 10.0%, 5.0%, and1.0% respectively.

Table 5. Marketers perceived challenges with gathering, processing and sales of African breadfruits in Mbaise, Nigeria. 2012.

Challenge	Breadfruit Gathering (n=80)	Number (%)	Breadfruit Processing (n=80)	Number (%)	Breadfruit Sales (n=101)	Number (%)
Decline in fruit gathering/harvests.	Increase in number of small, poorly seeded fruits	60 (75.0)	Increase in number of poor quality seeds.	63 (78.8)	Large quantities of seeds of low commercial value.	23 (22.7)
High marketing operating cost.	Time consuming, involves collective labour provided by hired and household members	57 (71.3)	Tedious local method and high initial cost of machines.	48 (60.0)	nil	0 (0.0)
Transportation difficulties.	Heavy as head loads except with wheel barrows	32 (40.0)	nil	0 (0.0)	Dilapidated and flooded rural roads	6 (5.9)
Seasonality of Fruiting/ripening.	Ripen fruits are scarce during dry seasons	73 (91.3)	Use large quantities of potable water procured at high cost to wash seeds during the dry season	54 (67.5)	Many unmet consumer demand during the dry season	17 (16.8)

Source: Field Survey, 2013; Figures in parentheses are percentages

Challenges with gathering, processing and sales of African breadfruits

Marketing activities associated with African breadfruits are not quite easy as they are fraught with difficulties and setbacks. These challenges as observed by the respondents are shown in Table 5. The table revealed that stakeholders in breadfruit marketing observed decline in fruit gathering/harvest, high marketing operating cost, difficulties in transportation, and seasonality of fruit yield as obstacles to marketing of breadfruits in the area. With respect to decline in fruit gathering/harvests it was observed that gathered fruits had in their midst many small and poorly seeded fruits. This was confirmed by processing that revealed relatively high proportion of poor quality seeds with low commercial value.

The high marketing operating costs was in terms of labour costs for gathering of fruits as expressed by 71.3% of the gatherers; and drudgery associated with processing ripe fruits expressed by 60.0% of processors and much time spent on these activities doing them with traditional methods. Where machines were used, high initial cost of procuring the machines was a hindrance also. Marketing challenges expressed by 40.0% of fruit gatherers as transportation difficulties are the weights of ripe breadfruits that constituted heavy head loads when lifted manually except with use of wheel barrows. There was also dilapidated rural roads that made it difficult to transport processed breadfruits to the local markets as observed 5.9% of the stakeholders in marketing of breadfruits. The ripe breadfruits were scarce during the dry season as noted by 73.0% of the gatherers and for the ones available, the processors (67.5%) complained of using large volume of potable water procured at high cost for washing off the slimy endocarps of the fruits. During the dry season, the supply of marketable seeds is small such that 16.8% of the traders in the local markets complained of not meeting much of their customers demand.

CONCLUSIONS

This study concluded as follows:

-There were high returns from breadfruit marketing enterprises in the area. Breadfruit gatherers/farmers, processors and traders had positive surpluses, Gross margin, and net profit from sale of processed breadfruits.

-Gathering of breadfruits, its processing, storage, transportation, and marketing help to add value at each stage of these marketing activities.

-Two factors, level of education attainment and monthly household income most highly and positively determined decision to supply breadfruits in domestic Ahiazu markets of Nigeria. This means that the highly educated farmers/breadfruit gatherers earning relatively high monthly farm income took positive decisions of supplying more breadfruits to buyers in domestic Ahiazu markets of Nigeria.

-Other important determinants of decisions to supply breadfruit in the study area were gender, hired labour and farming experience.

-Women farmers gathered, processed and supplied more breadfruits than did the male farmers in Ahiazu area, Nigeria.

-Obstacles to marketing of breadfruits in the area included decline in fruit gathering/harvest, high marketing operating cost, difficulties in transportation, and seasonality of fruit yield.

Policy Implications

Many people living in rural areas of southern Nigeria where African Breadfruit thrives who are poor or unemployed can make enviable living from gathering and processing this fruits for its seeds or further for its flour or its roasted seeds for snacks. This will go a long way to alleviating poverty and relieving hunger in the area. In addition to formal education, housewives taking decisions of family dietary menu should be informally educated by rural sociologists/dieticians on the nutrient composition of traditional foods like African breadfruit to enrich their meals.

Cheap and affordable breadfruit shelling machines should not only be designed but should be commercialized to reach all who

need it to process the seeds. Research into moisture control should be commissioned by horticultural research institutes to recommend best moisture levels in which shelled seeds can be stored to ensure regular supplies of the seeds in the market during the off seasons. We equally recommended provision of credit support to enable fruit gatherers purchase and use shelling machines and good storage facilities to smooth any fluctuations in supplies during off-seasons and help fight overdependence of households on roots and tubers.

REFERENCES

[1]Adepoju, A.A., Salau, A.S., 2007, Economic valuation of non-timber forest products, MPRA Paper No. 2689. Available at http://mpra.ub.uni.muenchen.de/2689/. Accessed 15/12/2007

[2] Babalola, F.D, Agbeja, B.O., 2010, Marketing and distribution of *Garcinia kola* (Bitter kola) in southwest Nigeria: opportunity for development of a biological product. Egyptian British Biological Society (EBB Soc) Egyptian Journal of Biology 12:12-17.

[3] Baiyeri, K.P., Mbah, B.N., 2006, Effects of soilless and soil-based nursery media on seed emergence, growth response to water stress of African breadfruit (*Treculia africana*). African Journal of Biotechnology 5(15):1405-1410.

[4]Burt, L., Wolfley, B., 2009, Production and marketing costs. Farmer-to-Consumer marketing. A Pacific North West Extension Publication, Oregon State University, Washinton State University, and University of Idaho. PNW 202-E.

[5]De Groote H., Kimenju, S.C., Morawetz, U.B., 2011, Estimating consumer willingness to pay for food quality with experimental auctions: the case of yellow versus fortified maize meal in Kenya. Agricultural Economics(42):1-16.

[6]Ekpenyong, E.J., 1980, Solvent extraction and characterization of oil from the seeds of *IrvningiaGabonensis* (African mango) and *Treculiaafricana* (African breadfruit).Unpublished B.Sc. Degree thesis.Department of Food Science and Technology University of Nigeria Nssukka, Enugu State, Abia state, Nigeria.

[7] Ejiofor, M.A.N., Okafor, J.C., 1997, Prospects for commercial exploitation of Nigerian indigenous fruits and seeds through foods and industrial products formulation. International Tree Crop Journal (9):119-129.

[8]Fassi, O.S., Elemyimni, A.F., Fassi, A.R., 2004, Chemical properties of raw processedbreadfruit seed flours. Journal of Food, Agriculture and Environment (2):65-68.

[9]Giami, S.Y., Adindu, N. Akusu, M.O., Emenike, J.N.T., 2000, Composition, Function and Storage Properties of Flour from Raw Heat Processed African Breadfruit (*Treculiaafricana*).*Deane seeds plant food for human nutrition* (55): 357-368.

[10] Mbakwe, R.C., 2005, The influence of Budwood Physiology on the Gestation Period of fruit Crop-*Treculiaafricana* (African breadfriut).*Journal of Agriculture and Food Science* 3(1): 1-4.

[11] National Bureau of Statistics (NBS), 2006, Legal Notice of the Publication of Breakdown of National and State Totals. Official Gazette FGP 71/52007/2,500 (OL24). www.nigerianstat.gov.ng. accessed 22/3/2007.

[12] Nwabueze, T.U., 2006, Effect of Hydration and Screw Speed on the nutrient and acceptability of extruded ready to eat African breadfruit (*Treculiaafricana*) Snack. *Niger-food J.*, 24(1): 107-113.

[13]Nwigbo, S.C., Achebe, C.H., Chinwuko, E.C., Tagbo, D.A., 2008, Design of Breadfruit Shelling Machine.African Research Review. *International Multi-Disciplinary Journal* ISSN 1994-9057: 2 (4): 1-16.

[14]Nzekwe, U., Ojeifor, I.M., Nworie, H.E., 2010, Assessment of the Gestation Period and Economic yield of African Breadfruit (*Treculiaafricana*) Var. *africanaDecne Moraceae.* Agro-Science *Journal of Agriculture, Food, Environment and Extension*. 9(1):18-23.

[15]Obibuaku, L.O., 1983, Agricultural Extension as a Strategy for Agricultural Transformation.(283) p. University of Nigeria Press, Nssukka, Enugu State, Nigeria.

[16]Ojoko, S.S., 2001, *Agricultural Education : Theory and Practice*. Sprigfield Publishers Owerri, Imo State, Nigeria.

[17] Okafor, J.C., 1985, Indigenous Fruit Production and Conservation in Nigeria. Proceedings of National Fruit Production Workshop held at Office of Federal Agricultural Coordinating Unit (FACU) Ibadan, Nigeria on 14th-16th March, 1985. pp. 50-62.

[18]Okeke, E.C., Ene-Obong, H.N.,Uzuegbunam, A.O., Ozioko A.O., Kuhnlein, H., 2008, Igbo Traditional Food System: Documentation, Uses and Research Needs. *Pakistan Journal of Nutrition* 7 (2):365-376

[19]Okeke, J.O., 2005, Solvent Extraction and Characterization of Oil from the Breadfruit seeds (*Treculiaafricana*). Unpublished B.Sc. Degree thesis, Department of Food Scienceand Technology Abia State University, Uturu, Abia State, Nigeria.

[20] Olaitan, S.O., 1984, *Agricultural Education in the Tropics*. In O.C. Onazi ed. Macmillan Intermediate Agriculture Series. Macmillan Publishers London.