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Potentials and Marketing of Fresh African Breadfruit (*Treculia africana*) Seeds in Anambra State, Nigeria

Sylvia Ifeoma Ofoedu[1], Celestine Obi Ugwumba[1], Sunday Angus Chidebelu[2]

[1]Department of Agricultural Economics and Extension, Chukwuemeka Odumegwu Ojukwu University (Formerly Anambra State University), Awka Main Post Office, Awka, Nigeria

[2]Department of Agricultural Economics and Extension, University of Nigeria, Nsukka, Nigeria

Email address

profcele2014@gmail.com (S. I. Ofoedu), sylviaifyofoedu@gmail.com (S. I. Ofoedu)

Abstract: The need to identify the potentials of African breadfruit, increase local production of its fresh seeds, reduce importation from neighbouring States, and improve the marketers' income informed this study. The study specifically examined the potentials, profitability, determinants of profit and constraints to marketing of fresh African breadfruit seeds. Multistage, purposive and random sampling methods were used to select 120 respondents. Pre-tested questionnaire was administered to the respondents through personal interview for data collection. Collected data were analyzed using means, marketing margin, enterprise budgeting and multiple regression. Findings indicated that African breadfruit has potentials for the creation of employment opportunities due to its diverse uses for food, firewood, feed, medicine, etc. The enterprise proved more profitable for the retailers than the wholesalers with marketing margin, mean net marketing income and net return on investment figures of 52%, 29%; ₦873,055, ₦347,068; and 5.9, 2.0 respectively. Gender, age, educational level and marketing experience exerted positive and significant effects on the marketers' profit. Major constraints to African breadfruit seeds marketing were scarcity of fresh seeds, poor preservation and processing techniques and deforestation. Government should introduce the use of budded African breadfruit seedlings in her agro-forestry programmes; sensitize the people on deforestation, afforestation, reforestation, regulations for sustainable production, and ways of tapping the full potentials of African breadfruit for economic, commercial, industrial and health benefits.

Keywords: African Breadfruit, Potentials, Marketing, Profit, Anambra State, Nigeria

1. Introductions

African breadfruit (*Treculia Africana)* is a tree specie in the genus, *Treculia (T)* and family, *Moraceae* (Walker, 2009). It is a native of Africa as indicated by its name (Atuanya, Aigbodion and Nwigbo, 2012). African breadfruit is an important economic tree; it sustains population during planting season, when the major staples (yam, rice, corn and cassava) are under cultivation (Ariahu, Ukpabi and Mbajunwa, 1999). In Nigeria, a lot of traditional names are given to African breadfruit which include, "Bafafula" in Hausa, "afon" or "bere-foo-foo" in Yoruba, "ediang" in Efik and Ibibio, and "izea" in Ijaw (Dobby, 2012), "ize" in Benin (Ugwu and Iwuchukwu, 2012). The most popular name is

"Ukwa", the Igbo name (Nuga and Ofodile, 2010). The geographical distribution of *Treculia africana* in Africa is Senegal, South Sudan, Angola, Nigeria, west and central Africa. It can grow until 1,500m altitude and can be productive for decades (Nuga and Ofodile, 2010).

The fruit contains seeds in seed hull of brownish black, which is like orange pips embedded at various depths in the fleshy elongated bracts. The edible seed is whitish yellow. The de-hulled seeds are eaten as food; serve as flour for preparation of biscuits, cookies, loaves; and a potential source of oil (Atuanya, Aigbodion and Nwigbo, 2012). Chips of breadfruit have been commercially manufactured in Trinidad and Barbados. Breadfruits are multipurpose trees that improve soil conditions and protect water sheds while providing food, timber and animal feed. It has multiple uses,

long productive and low-maintenance life (Lucas and Ragone, 2012). The seed flour has bread making properties (Giami and Amasisi, 2005). The bread made from breadfruit flour has been found to be more nutritious than the wheat flour. In Nigeria thefresh seeds are boiled and eaten as main dish (Nuga and Ofodile, 2010). African breadfruit, serves as a cheap source of protein to the rural poor who cannot afford the luxury of buying meat or other sources of animal protein (Ugwu and Iwuchukwu, 2012).

It is low in fat and much healthier source of carbohydrate than white rice and white pasta. It is a good source of fiber, calcium, copper, iron, magnesium, potassium, thiamin, niacin, antioxidants and caratoenoids. It contains good quantities of omega-3 and omega-6 fatty acids (Morton and Miami, 1987). The grains have an excellent polyvalent deictic value. The biological value of its proteins exceeds even that of Soya beans (Osabor, Ogar, Okafor and Egbung, 2009). It is a good source of vitamins and minerals like beta-carotene, vitamin C and folic acid (Dobby, 2012). African breadfruits also contain riboflavin, and phosphorous. All these minerals and vitamins provide essential nutrients to the body, hence they hasten and stimulate skin and hair growth, regulate metabolism, promote reproduction and stimulate bone growth and health. African breadfruit even helps in proper functioning of the intestine and bowel movements and clears the build-up of junk in intestines. He also stated that the consumption of it on a daily basis can even help in reducing the risk of colon cancer. The presence of the secondary metabolites accounts for usefulness of the seed for medicinal purposes (Ebena, Essien and Ekpa, 1995). For instance, a decoction of African breadfruit may relieve asthma (Atuanya *et al.,* 2012), lower blood pressure (Osabor *et al.,* 2009). The crude extract has been used in treatment of mental illness (Aderibigbe, Adeyemi and Agboola, 2010). The fruit is used in the treatment of leprosy and also utilized as a laxative (Osabor *et al.,* 2009). It is recommended to be used to support human and animal feed formation (Atuanya *et al*., 2012). It is considered to be a potential item for chick feed than cassava or maize (Lucas and Ragone, 2012). Many people are now interested in the consumption of highly nutritive, proteinous, important and effective products like African breadfruit.

Marketing of African breadfruit entails production, processing, supplying the products to the ultimate consumers. Agricultural producers are scattered in remote villages, marketing has to take place in order to make the products to reach consumers for its final use and consumption (Obiekwe and Ugwumba, 2016). Agricultural marketing is a form of marketing that encompasses all goods and services related to the field of agriculture. These products will directly or indirectly support the effort to produce and deliver agricultural products from the farm to the consumer. In other words, an efficient marketing sector is the most important multiplier of economic development (Adakaran and Chidebelu, 2012). As a matter of fact, information is lacking on marketing of African breadfruit in Anambra State. According to Dobby (2012), African breadfruit is highly priced in the market due to its nutritious and tasty values. Also, Taylor and Ragone (2007) reported that one of its strengths is its high price in local markets. They also recommended that there is need to choose innovation approaches to improve marketing, develop trade agreements, promoting and support export and import substitution polices, where necessary to support trade in breadfruit products. African breadfruit has both domestic and export potentials and other valued uses.

African breadfruit is a possible commercial raw material for production of vegetable oil, pharmaceuticals, soaps, perfumes and paints (Osabor *et al.,* 2009). Its oil is free from rancid odour and taste (Arawande, Ajaji and Adewumi, 2009). African breadfruit marketing can create wealth by opening ways for other business opportunities; it can create jobs for the people in the area and beyond if well developed. Since Anambra State has huge resources and potentials for different agricultural practices (Anambra State Ministry of Agriculture and Rural Development (ASMARD), 2008), why is African breadfruit seeds having limited supply that marketers should source it even from outside the State. Therefore, African breadfruit is an important crop in the area to study its marketing.

2. Methodology

The study area is Anambra State of Nigeria. The State is located in the South East geo-political zone of Nigeria. The State capital is Awka. Its population is 4,182,844 (National Population Commission (NPC), 2006). It is made up of four agricultural zones namely Aguata, Anambra, Awka and Onitsha (ASMARD, 2008). The state occupies an area of 4,416km^2, 70% is arable land and less than 55% of this arable land is under cultivation. The rainy season lasts from April to November, while the dry season ranges from November to March. The harmathan is usually experienced between December and February. The mean annual rainfall is 2000 mm. The average annual temperature is 32°C and minimum temperature is 23°C. The mean annual relative sunshine intensity is 5.2 hours (ASMARD, 2008). The State has great potential for agricultural development. The climate of the area is comparatively good. It is favourable for crop production, livestock farming, fishery and agro-forestry (ASMARD, 2008). Crops, livestock and fisheries are the main stay in the farming system of the State. Off-farm activities like agricultural processing and marketing are also vital components (Nwalieji, Igbokwe and Nsoanya, 2012). Marketing of agricultural products in Anambra State developed from the rural periodic markets which came up every four days (Eke, Oye, Afor, Nkwo), in each community of the LGAs. On periodic market days, agricultural producers/farmers assemble their goods/output at the periodic markets. However, both local consumers and agro-farm produce marketers, purchase the goods for consumption or resell. Some petty traders in this zone also take African breadfruit seeds to the urban cities/markets where they hawk the goods or sell to agro-food merchants. In Anambra State

there is adequate potentials for African breadfruit production and supply. The Anambrarians cherish African breadfruit meal very much that they serve it as a special delicacy in any important gathering.

Multistage, purposive and random sampling techniques were used to select 120 respondents for the study. Data used were obtained from primary source through the administration of pre-tested questionnaire administered to the respondents by personal interview. Data were collected on the marketers'socio-economic factors, cost and returns variables, potentials and constraints to African breadfruit seeds' marketing. Data on potentials and constraints to African breadfruit seeds' marketing were collected by the means of a four-point Likert-type scale by using the responses: highly valued (HV, 4), valued (V, 3), moderately valued (MV, 2), and not valued (NV, 1); and very serious (VS, 4), serious (S, 3,), not serious (NS, 2), and not a problem (NP, 1) respectively. A critical mean of 2.5 ((4+3+2+1)/4) was computed in each case. Data were analyzed using means, percentages, marketing margin, enterprise budgeting and ordinary least squares (OLS) regression.

Marketing margin was determined by finding the algebraic difference between the farmer's price and consumer's price at every level of the market. Symbolically, marketing margin is given as: Marketing margin (MM) = Consumer's price (CP) – Farmer's price (FP)

Wholesaler's margin (WM) =Wholesaler's price (WP) – Farmer's price (FP) Retailer's margin (RM) = Consumer's price (CP) - Wholesaler's price (WP)

Percentage marketing margins are given as:

Marketing Margin (MM) = consumer's price (CP) – Farmer's price (FP) x 100 ÷ FP

Wholesaler's Margin (WM) = WP – FP x 100 ÷ FP Retailer's Margin (RM) = CP - WP x 100 ÷ WP

Net income (NI) was determined by considering the following:- The total revenue which was total value of products sold. Variable cost (VC) included purchase, transportation /handing costs. Fixed costs were rents, levies, and depreciation on measuring and processing materials. A straight line depreciation method specified as: Depreciation = Purchase price of the asset – Salvage value ÷ Economic life of the asset. Total cost (TC) = Total variable cost (TVC) + Total fixed cost (TFC). Gross Margin (GM) = Total revenue (TR) – Total variable cost (TVC). Net income (NI) = GM – TFC. Mean net income (MNI) = Net income ÷ Number of respondents, and Net return on investment (NRI) = NI ÷ TC.

The multiple regression model used to determine the effects of socio-economic factors of the respondents on profit is implicitly given as: PFT= f (GEN, AGE, MAS, EDL, MKE, HHS, OCC; e). The explicit forms of the model are given as: Linear: PFT = a + b_1GEN+b_2AGE + b_3MAS + b_4EDL + b_5MKE + b_6HHS + b_7OCC + e. Exponential: InPFT = a+b_2AGE + b_3MAS + b_4EDL + b_5MKE + b_6HHS + b_7OCC + e. Semi-log: PTF = a + b_1InGEN+ b_2InAGE +b_3InMAS + b_4InEDL + b_5InMKE + b_6InHHS + b_7InOCC + e.

Double-log: InPFT= a +b_1InGEN+ b_2InAGE +b_3InMAS + b_4InEDL + b_5InMKE + b_6InHHS + b_7InOCC + e.

Where: PFT= Profit (₦), GEN = Gender (Dummy: male = 1, female =2) AGE = Age of the farmer (years) MAS = Marital status (dummy: Married = 2, single =1 and widow =0), EDL= Education level (years) MKE= Marketing experience (years)

HHS= Household size (numbers)

OCC꞊Occupation (class categories)

e = Stochastic error term.

The functional forms (linear, exponential, semi-log and double-log) were tried with the data and output of the linear form was adopted as best fit and the lead equation. This was based on the values of the coefficient of multiple determinations (R^2), significant variables and *a priori* econometric expectations.

3. Results and Discussion

3.1. Profitability of Fresh African Breadfruit Seeds Marketing

Although fruits in different stages of development were continuously present on the tree all year round, the main ripening season was February to October while the lean season was November to January. The fresh processed seeds were commonly retailed in cigarette cup (0.6kg) at ₦350 per cup and wholesalers in painter plastic bucket (5kg) at an average consumer's price of ₦10,500 (₦350 x 30 cups); farmer price of ₦7,500 and wholesaler's price of ₦8,500.

Result of the marketing margin analysis indicated mean consumer price of ₦3,600, farmer price of ₦1,817 and wholesaler price of ₦2,343 in the area (Table 1). There from, percentage marketing margin was 29% and 52% for the wholesalers and retailers respectively. Taylor and Ragone (2007) reported high price of fresh African bread fruit seeds in local markets while the FAO (2014) stated that cost is an additional threat of food security, high and volatile food prices restricting poor people's access to food. The law of one price is another way of stating the concept of purchasing power parity. The law exists due to arbitrage opportunities. If price of a commodity is different in one market, then an arbitrage will purchase the goods in the cheaper market and sell it where prices are higher. African breadfruit has turned to Giffen goods, even at a high cost; consumers utilize it as a special delicacy in any important gathering, violating the law of demand.

***Table 1.** Marketing margin/painter (5kg) of fresh African breadfruit seeds at peak period.(₦).*

Variable State	Awka Agricultural Zone Mean for markets		Aguata Agricultural Zone Mean for markets		Anambra Grand Mean for the markets LGA
	Njikoka LGA	Awka North LGA	Aguata LGA	Nnewi South LGA	
Consumer P	3,600	3,600	3,600	3,600	3,600
Farmgate P	1,867	1,700	1,833	1,867	1,817

Variable State	Awka Agricultural Zone Mean for markets		Aguata Agricultural Zone Mean for markets		Anambra Grand Mean for the markets LGA
	Njikoka LGA	Awka North LGA	Aguata LGA	Nnewi South LGA	
Wholesale P	2,367	2,267	2,367	2,367	2,342
Retail M	52	50	53	52	52
Wholesale M	26	34	29	26	29
Marketing M	93	104	96	93	97

Source: Survey data, 2016. Note: P = Price.

The enterprise budgeting analysis (Table 2) showed that the total revenue from wholesalers of African breadfruit seeds was ₦7,848,000 and that of retailers ₦15,336,000. The total variable costs were ₦2,601,350 and ₦2,212,300 while the total fixed costs were ₦2,622,040 and ₦2,226,220 for the wholesalers and retailers respectively. The variable costs constituted 99.3% of the total cost of marketing the fresh seeds. The wholesalers and retailers realized gross margin, net marketing income, mean net marketing income and net return on investment of ₦5,225,960 and ₦13,109,780; ₦5,205,270 and ₦13,095,860; ₦347,018 and ₦873,055; and 2.0 and 5.9 respectively.

***Table 2.** Estimated profitability of the marketing of fresh African breadfruit seeds.*

Variable	Wholesaler	Retailer	Wholesaler & Retailer
Total revenue (TR)	7,848,000	15,336,000	23,184,000
Total variable cost (TVC)	2,601,350	2,212,300	4,813,650
Total Fixed cost (TFC)	20,690	13,920	34,610
Total cost (TC=TVC+TFC)	2,622,040	2,226,220	4,848,260
Gross margin (TR-TVC)	5,225,960	13,109,780	18,335,740
Net income (GM-TFC)	5,205,270	13,095,860	18,301,130
Mean net income (NI/n)	347,018	873,055	1,220,073
Net return on investment (NI/TC)	2.0	5.9	3.8

Source: Survey data, 2016.

This result inferred that for every ₦1.00 invested in the enterprise the wholesalers made ₦2.00 against the retailers'₦5.90, hence the enterprise was profitable. This finding corroborates Kola-Oladiji, Adesope and Adio (2006) who reported a positive net return on investment of ₦0.70 for fresh African breadfruit seeds marketing at Ibadan Metropolis of Oyo State, Nigeria. African breadfruit is a viable business its marketing can boost the income of the marketer. The marketers may be happy for the new development (very high returns), but it may indirectly affect their business negatively since the consumers may minimize purchase of the product which will result in more wastages from unsold purchases especially for the retailers.

3.2. Determinants of Profit Realized by Fresh African Breadfruit Seeds' Marketing

Determinants of profit realized by the fresh African breadfruit seeds' marketers were ascertained using the multiple regression analysis. A total of seven independent variables namely gender represented by GEN, age (AGE), marital status (MAS), educational level (EDL), marketing experience (MKE), household size (HHL) and occupation (OCC) were included in the model. Four functional forms of the regression model (linear, exponential, semi-log and double log) were fitted with the data and ran using the MINITAB statistical package. Results as shown in Table 3 showed that output of the linear model produced the best result in terms of economic, statistical and econometric *a priori* criteria and was adopted as the lead equation. Out of the seven predictors gender, age, educational level and marketing experience exerted significant effects on the marketers' profit while the rest three, marital status, household size and occupation were not significant.

***Table 3.** Determinants of profit of fresh African breadfruit seeds' marketers.*

Predictor	Linear	Exponential	Semi-log	Double-log
Constant	43597 (10.03)	4.67783 (172.58)	830 (0.12)	4.44486 (107.57)
GEN	4505 (3.15)*	0.034227 (3.83)*	12119 (2.29)**	0.09553 (3.00)*
AGE	145.99 (3.27)*	0.0007634 (2.74)*	19702 (3.84)*	0.10542 (3.41)*
MAS	107.7 (0.24)	0.000655 (0.23)	1392 (0.62)	0.00786 (0.58)
EDL	811 (1.98)**	0.004322 (1.68)***	2342 (1.97)**	0.01227 (1.87)***
MKE	659.60 (10.21)*	0.0038097 (9.45)*	30146 (9.12)*	0.176655 (0.88)*
HHS	-207.8 (-0.94)	-0.000795 (-0.58)	-4619 (-1.63)	-0.2182 (-1.28)
OCC	-13.8 (-0.07)	0.000126 (0.10)	-347 (-0.28)	-0.000565 (-0.8)
R^2	80.1%	77.7%	76.4%	75.5%
R^2 (adjusted)	78.5%	76.0%	74.7%	73.6%
F. statistics x	52.76	45.90	42.66	40.49
D-W statistic	1.74	1.70	1.65	1.57

Source: Field survey, 2016. Note: Figures in () are T-statistic values. * = Significant at 1%. **= Significant at 5% level. *** = Significant at 10%.

The coefficient of age was positive and significant at 1% level. This implied that the older marketers were more likely to realize higher profit than the younger ones. The reason could be that they possessed more resources which enabled them to invest more in the business and consequently realized better profit. This finding is in agreement with Ugwumba and Nwankwo (2013) that the older marketers who were able to accumulate more resources invested more than the younger ones, hence earned more net marketing income.

Educational level which also positively influenced the profit and significant at 5% level, implied that the more educated the marketers were, the more they rightly utilized the marketing mix, considered buyers behaviour and added value to the value chain of the product, in order to make the product more valuable, more available, more accessible and more profitable. The finding agrees with Food and Agriculture Organization (FAO) (2006) which reported that education was an important source of empowerment for increased productivity in all facts of life.

Experience of the marketers was also positively significant at 5% level. The implication of this finding was that experienced marketer efficiently and effectively maximized profit with available resources. This finding conforms to Kola-Oladiji *et al.* (2006) who exerted that many years of business experience reduce a marketer's inefficiency and thus increase productivity and income.

The coefficient of multiple determinants (R^2) was 80.1% implying that 80.1% of the variation in profit of the marketers was explained by variations in the independent variables while the remaining 19.9% was due to error. The F-statistic value of 52.76 was significant and confirms the overall significance of the regressors on the regressand and goodness of fit of the model.

3.3. The Potentials of African Breadfruit

The African breadfruit has multiple uses as specified in Table 4. It is most importantly valued for its seeds prepared in different ways for food (Nuga and Ofodile, 2010);

followed by the use of its wood for firewood Atuanya *et al.,* 2008); green leaves, fruit pulp and seed hull utilized in feeding some animals (Osabor *et al.,* 2009); the tree planted for soil conservation; exudates from the tree "Osu" used as melon soup ingredient; by-products from the tree parts are used in traditional medicine (Appiah, 2010; Osabor *et al.*, 2009); timber from the tree is used in building construction; and many of its undeveloped potentials possible commercial raw materials for the production of vegetable oil, perfumes, pharmaceutical, flour, feed, soap, and paints.

Table 4. *The uses of African breadfruit in the state.*

Uses	Mean score	Rank	Decision
Food	2.9	1st	HV
Firewood	2.2	2nd	HV
Feed	1.8	3rd	HV
Soil conservation	1.2	4th	V
Ingredient	1.1	5th	V
Construction material (s)	0.6	6th	V
Traditional medicine	0.2	7th	MV
Raw material (s)	0.0	8th	NV

Source: Field survey, 2016. Note: HV = Highly valuable. V= Valuable. MV = Moderately valuable. NV= Not valuable.

3.4. Constraints to Fresh African Breadfruit Seeds' Marketing

The marketing of fresh African breadfruit seeds had some problems militating against it both at the wholesale and retail levels. These problems ranked in descending order of seriousness were scarcity of fresh seeds, poor preservation and processing techniques, deforestation, lack of fund, high cost of the product, high cost of transportation, inadequate water supply, poor road net work, pest and diseases. This finding agrees with Taylor and Ragone (2007) who recognized shortage period/shelf life as one of the weaknesses affecting African breadfruit seeds' marketing. Also, it corroborates Ugwu and Iwuchukwu (2012) that the problems of undesirable products and undesirable colour of preserved seeds in preservation technique can lead to the scarcity of the product after bumper harvest.

Table 5. *Problems affecting African breadfruit marketing.*

Constraint	Mean score	Rank	Decision
Insufficient/scarcity of supply	2.8	1	**
Poor preservation technique/ Poor quality products after processing	2.6	2	**
Deforestation	2.5	3	**
Lack of fund	1.4	4	*
High cost of the product	1.3	5	*
High cost of transportation	1.2	6	*
Lack of regular water supply	0.8	7	*
Poor feeder/ access	0.6	8	*
Pests and diseases	0.4	9	*

Source: Field survey; 2016. Note: ** = Major problem. * = Minor problem.

4. Conclusion and Recommendations

The study established that fresh African breadfruit seeds' marketing was a profitable venture in Anambra State. The numerous tapped and untapped potentials of African

breadfruit could be used to create business opportunities for many unemployed youths and women in the State. The profitability, income and potential uses would increase if the constraints to marketing identified by the study are addressed.

Policy measures geared towards the provision of budded

breadfruit seedlings, credit facilities, all season feeder roads, modern processing facilities, and the sensitization of the people on aforestation techniques and dangers of deforestation will minimize cost of production, increase productivity, output and supply of product by producers as well as profit realized by the marketers.

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