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Assessment of African Breadfruit (Treculiaafricana) and its Potential Demand by Rural Households in Udi agricultural zone of Enugu State, Nigeria.

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A R T I C L E I NFO

Key Words

African breadfruit

Demand forecasting

Food security

Farm livelihood

ABSTRACT

This research examined the potential demand of African breadfruit (*Treculiaafricana*) by rural households in Udi Agricultural Zone in Enugu State, Nigeria. Specifically, the work determines household demand for African breadfruit; estimates price, income and cross-price elasticities of demand for African breadfruit among other objectives. Sampling technique used was multi-stage random sampling where one hundred (100) households that consume breadfruit were interviewed. Data collected came from mainly primary sources with well-structured questionnaires. Elasticity of demand models and descriptive statistics were used to analyze collected data. From the result, it shows that the household demand for breadfruit is high in the study area. The mean quantity demanded per household per month was 5.08kg. The research findings further show that the demand for African breadfruit was observed to be price inelastic with a value of -0.254. But for income elasticity, African breadfruit was observed to be a normal good and relatively income inelastic with a value of 0.3574. The cross-price elasticity of African breadfruit indicated 0.153 when compared with cowpea as substitute commodity. The results of the study indicated that African breadfruit is sold at a higher price in the study area as there is greater demand for commodity. The research recommends that there is need for more individuals, government at all levels to promote and partake in production of African breadfruit due to high demand of the produce/products in the area.
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1.0 Introduction

African breadfruit has been an important food commodity and it used to be widely consumed especially in Igbo land (even in Udi agricultural zone the study area) of Enugu State, Nigeria. However, the rate of consumption of African breadfruit seems to be in steady decline as it is now usually scarce to find and costly to acquire in different parts of south-east Nigeria and even in Enugu State and particularly in the study area. Historically, African breadfruit (*Treculiaafricana)* is produced by *Treculia*, a wild tropical evergreen tree. As reported by (Osabor et al, 2019), African breadfruit has immense potential as a nutritional source for men. *Treculiaafricana* is native to many parts of West and tropical Africa where Nigeria, Enugu State and study area is located.

According to Nwufo and Mbah (1998), African breadfruit is given many names in various localities where it is found. The Ibos call it "*ukwa*", Efiks, Ibibios, Benin "*ize*", Yorubas "*afon*" and Annangs "*ediang*". In English, the fruit

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is referred to as any of the following - wild jackfruit, African breadfruit or African boxwood. Nzeh, et.al (2018), reported that it is a non-timber forest product and an edible traditional fruit. Furthermore, in the views of Nzeh, et.al (2018) African breadfruit is related to other exotic fruits like breadnut, jackfruit, figs and mulberries. Nzeh, et.al (2015) further confirmed that African breadfruit is consumed in Nigeria, where it is eaten as a main dish and that the seeds are of particular interest because of their high nutrition value to many households. But Uluocha et al. (2016) noted that the edible seeds are valuable food stuff among the Igbos in particular. Although African breadfruit occurs naturally in the wild, they are frequently or extensively found around human dwellings and in farmlands as a result of cultivation.

The seeds from African breadfruit are highly nutritious as critical analysis of it shows that it constitutes a cheap source of vitamins, minerals, proteins, carbohydrate and fats. The breadfruit is a staple crop in many parts of Nigeria especially in Enugu State and even in the study area. Its food value and market potentials have been reported by Ugwu and Oranye, (2006).

In this study, the bulk of household demand makes for market demand. Therefore, household demand for agricultural produce goes a long way to determine the level of interest and improvements the commodity will experience. Literature from this study shows that not many people are involved in the production and marketing of African breadfruit and this may be the reason why the produce is often overpriced compared to other staples like cowpea as reported by Uluocha et al. (2016). Based on this, knowledge of the household demand for African breadfruit will help in understanding of its demand elasticity. Also it is important determine if the fruit is worth consideration as for more investment option in the study area.

The main objective of the work is to assess the potential demand for African breadfruit (*Treculiaafricana*) by rural households in Udi agricultural zone of Enugu State, Nigeria. The specific objectives are to: (i) identify the socio-economic distinctiveness of households in the study area; (ii) determine household demand for African breadfruit; (iii) determine the price elasticity of demand for African breadfruit in the study area; (iv) determine the income elasticity of demand for African breadfruit in the study area; (v) determine the gross price elasticity of demand for African breadfruit in the study area.

2.0 Literature Review

2.1 Theoretical Literature

Demand theory is one of the core theories of microeconomics. In literature it aims to answer basic questions about how badly people want things, and how demand is impacted by income levels and satisfaction (utility). The theory of demand describes the relationship between consumer demand for goods and services and their prices. As more of a good or service is available, demand drops and so does the equilibrium price. People demand goods and services in an economy to satisfy their wants, such as food (breadfruit), healthcare, clothing, entertainment, shelter, etc.

Demand in terms of breadfruit is the quantity of breadfruit that consumers are willing and able to buy at a given price in a given time. In effect, effective demand is when the readiness to satisfy a want is backed up by the individual's ability and willingness to pay. The demand for breadfruit at a certain price reflects the satisfaction that an individual expects from consuming it. This level of satisfaction is referred to as utility and it differs from consumer to consumer. Built into demand are factors such as consumer preferences, tastes, choices, etc. The market system is governed by the laws of supply and demand, which determine the prices of goods and services. When supply equals demand, prices are said to be in a state of equilibrium. When demand is higher than supply, prices increase to reflect scarcity. Conversely, when demand is lower than supply, prices fall due to the surplus.

An expansion or contraction of demand occurs as a result of the income effect or substitution effect. When the price of a commodity falls, an individual can get the same level of satisfaction for less expenditure, provided it's a normal good. The

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substitution effect is observed when consumers switch from more costly goods to substitutes that have fallen in price. Sometimes, consumers or households usually buy more or less of a good or service due to factors other than price. The law of demand is violated when dealing with Giffen or inferior goods.

In this research, price elasticity of demand is the degree of responsiveness of demand to little changes in price of a commodity and it measures the extent to which the quantity of a commodity demanded by consumers changes as a result of a little change in the price of the commodity. It is the ratio of the percentage change in quantity demanded to the percentage change in price:

$\frac{\% \Delta Qd}{\% \Delta P}$ (Ande, 2008).

It can also be calculated using the formula; Price elasticity = b_n x ($\dot{x}_n/\bar{y}$)
Where b_n = coefficient of price of breadfruit,
$\dot{x}_n$ = mean price of breadfruit and
$\bar{y}$ = mean quantity demanded in kg

In addition, income elasticity of demand deals with the degree of responsiveness of demand to changes in income of consumers. It can be measured or calculated by dividing the percentage change in quantity demanded by the percentage change in income i.e., $\frac{\% \Delta Qd}{\% \Delta I}$(Ande, 2008).

It can also be calculated using the formula; Income elasticity = b_n x ($\dot{x}_n/\bar{y}$)

Where b_n = coefficient of income,
$\dot{x}_n$ = mean income and
$\bar{y}$ = mean quantity demanded in kg.

Finally, cross elasticity of demand is the degree of responsiveness of demand for a commodity to changes in the price of another commodity which was also used in research.

It can be calculated as:
percentage change in quantity demanded of commodity A/percentage change in price of commodity B

It can also be calculated using the formula; Income elasticity = b_n x ($\dot{x}_n/\bar{y}$)

Where b_n = coefficient of price of substitute,
$\dot{x}_n$ = mean price of substitute and
$\bar{y}$ = mean quantity demanded in kg.
Source: Osuafor et al. (2018).

2.2 Conceptual Framework

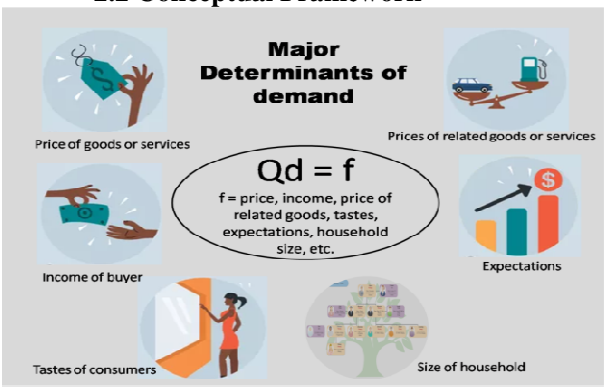

Figure 1: Major determinants of demand for African breadfruit

In figure 1 above, five factors influencing the demand for African breadfruit are shown. Quantity of breadfruit demanded is represented by 'Qd' which is shown to be a function (f) of price of the breadfruit, income of consumer, taste of consumer, size of household and price of substitute (e.g.cowpea).

3.0 Research Methods

The study was carried out in Udi Agricultural zone of Enugu State. Udi Agricultural Zone comprises two local government areas which are Udi and Ezeagu. Udi Agricultural Zone is located in the region of tropical rainforest belt. Its annual rainfall ranges between 15 to 203cm and the prevailing temperature is between 32°C and 37°C. The rainfall peak is in July and September each year as reported by Offor et al (2018).

In Udi agricultural zone just like Enugu state, farming is predominately the occupation of the householders which is done in a small-scale. Prevalent crops are cassava, yam, maize, rice, melon, groundnut, pepper and economic trees like oil palm, cashew, cocoa, oranges, kola nuts,

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African breadfruit and pears among other trees are found in the state as well as in the study area. There are forests of different density in Enugu state as reported by Nzeh, Eboh and Nweze (2018). Crops farm(s) are usually in small holding of about 1 to 3 hectares, but poultry production is carried out in some parts of the state but strictly on subsistence level, together with goat and sheep production (Chukwuone and Okeke, 2012).

3.1 Data Sources

In this research, primary data were collected through the use of well-structured questionnaires. Data collected were analyzed using relevant econometric and other statistical tools in other to achieve specific objectives.

Meanwhile, for sampling procedure, both purposive and random sampling techniques were employed to ensure a good spread of respondents for the study. In the first stage of the sampling procedure, within Udi agricultural zone which comprise of two (2) local government areas (Udi and Ezeagu) as earlier mentioned two (2) towns were selected in each local government area given us a total of four (4) towns. The second stage involves selection of communities where five (5) rural communities were selected purposively from each of the selected four (4) towns. This gave a total of twenty (20) communities. Third stage was the selection of respondents (that is, household heads). From the twenty (20) communities, six (6) household heads were purposively selected from each of the twenty (20) rural communities, making a total number of one hundred and twenty (120) household heads but during the analysis, only one hundred household-heads were used as twenty questionnaires from different respondents were discarded because they did not give satisfactory information as required.

3.2 Theoretical Framework

Different researchers across sub-Saharan Africa have studied various aspects of African breadfruit. In their various researches, they discovered that African breadfruit as a non-timber forest product has not been optimally exploited. In this study, the theory of demand is applicable to breadfruit as it is to other agricultural commodities. It is pertinent to note that a theory in science is not just a whim or an opinion; it is a logical construct of how something works, generally agreed upon by scientists and always in agreement with the available observation.

The law of demand introduces an inverse relationship between price and demand for a good or service like in this case, African breadfruit. It simply states that as the price of a commodity increases, demand decreases, provided other factors remain constant. Also, as the price decreases, demand increases. This relationship can be illustrated graphically in figure 2 below using a tool known as the demand curve.

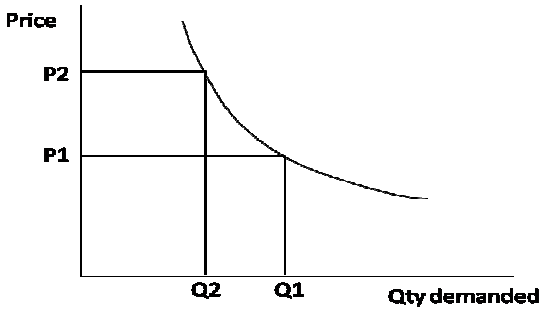

Figure 2: Relationship between price and quantity demanded of a commodity.

3.0 Model Specification

The analysis for the study involves the systematic and verifiable techniques, formula and procedures to compute and derive measures of variables and their relationships. Objective i and ii were analyzed using descriptive statistics like,

Mean $(\bar{X})=\Sigma fx/\Sigma f$

Where Σfx is the summation of the product of the frequency and the observations of variable X whereas, Σf is the summation of the observed frequency of the variables X.

The demand for African breadfruit is influenced by many factors including the ones stated above. Meanwhile, below are the coefficients for different elasticity.

Price elasticity = $b_1 \times (\dot{x}_1/\bar{y})$,
Income elasticity = $b_2 \times (\dot{x}_2/\bar{y})$,

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Cross price elasticity = b_3 x ($\dot{x}_3/\bar{y}$).

Where b_n = estimated coefficient,
$\dot{x}_n$ = mean value of the independent variable and
$\bar{y}$= mean value of the dependent variable.

For the purpose of this research, multiple regression models for realizing were used to analyze objectives iii, iv and v is represented as follows:
$Y = b_o - b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + r$

Where; Y = quantity of breadfruit demanded in kg; b_o = constant or intercept, X_1 = price of breadfruit in naira, X_2 = income of household in naira, X_3 = price of close substitute (cowpea/beans) in naira, X_4 = household size number, X_5 = household taste dummy and r = any other values not associated with the above values.

4.0 Results and Discussion

4.1 Socio-economic Description of Respondents in the Study Area

The socio-economic status considered in this study include sex, household status, age, marital status, educational qualification, household size, occupation, religion and the access of households to extension.

Table 1: Distribution of respondents according to their socio-economic characteristics

Variable	Frequency	Percentages (%)	Mean ($\bar{X}$)
Sex			
Male	30	30	
Female	70	70	
Household Status			
Father	15	15	
Mother	45	45	
Grandmother	5	5	
Son	15	15	
Daughter	20	20	
Marital Status			
Single	30	30	
Married	55	55	
Widowed	15	15	
Age			
≤20	25	25	
21-30	10	10	
31-40	35	35	34
41-50	20	20	
≥51	10	10	
Educational Qualification			
No formal education	16	16	
Primary school certificate	19	19	
secondary school certificate	37	37	
OND	7	7	
B.Sc.	16	16	
Ph.D	5	5	
Household Size			
≤5	25	25	
6-10	65	65	8
11-15	10	10	
Occupation			
Farming	29	29	
Trading	37	37	
Civil/Public service	12	12	
Artisan	15	15	
Others	7	7	
Access to Extension			
Yes	20	20	
No	80	80	
Rate of Extension Visit			S
Once a month	5	5	
Rarely	15	15	
Reasons for no access to extension			
Not sure they are in existence	65	65	
They don't visit community	15	15	

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Religion		
Christianity	89	89
African traditional religion	11	11

Source: Field survey, 2019.

The table 1 above shows that 70% of the respondents were female, while the remaining 30% were male. This implies that greater proportion of the households that are involved in African breadfruits in the study area was female. Though more females were involved in economic activities of the African breadfruits, it does not mean out-rightly that females dominate males in the study area. Rather, it can be attributed to females being more interested in the potentials of economic activities of the cash crop - African breadfruits than males.

Table 1 also reveals that about 35% of the respondents fall into the age range of 31-40years. Furthermore, 25% of the respondents' ≤20years, 20% of them were in the age category of 41-50years, whereas 10% of the respondents each were in the age range of 21-30years and ≥51 respectively. The mean age was 34. The result of the analysis revealed that majority of the respondents were in their active age, and are energetic to handle the tasks entailed in non-timber forest products economic activity like marketing and production of African breadfruits.

More critical findings as revealed in table 1 show that greater proportions (89%) of the respondents are Christians while 11% of them were African traditionalists. This implies that majority of the respondents in the study area are Christians.

Education is necessary for sustainable development, growth and sustainable use of available resources. It is the bedrock of knowledge and it increases the horizon of human activities, the understanding of his environment and dietary needs as reported by Mgbada, Ohajianya and Nzeh (2015).

According to table 1 above it shows that majority 84% of the respondents in the study area had formal education which means that they were mostly literates. Further analysis of table 1 indicated that only 37% of the respondents attended secondary school as 19% of the respondents had only primary education. Finally, as 16% of the respondents in the study area obtained their first degree, only 7% of the respondents had their national diploma whereas minority 5% of the respondents was doctorate degree.

The primary occupation of respondents usually represents those activities which occupy at least up to 50% of the working time of the households to support their financial base.

From Table 1 above, 37% of the respondents' primary occupation was trading, as 29% of them are into farming, but 15% and 12% of them were into artisan and public servant respectively. From the Table 1 above, not withstanding that higher percentage of the respondents had their post secondary education, these respondents still engage in economic activities of African breadfruit as means of employment and income generation. This implies that in rural areas like Udi agricultural zone of Enugu state, households do not always depend on white collar jobs.

Table 2 is a summary of results of the multiple regression analysis done to find out the effects of independent variables on demand for African breadfruit in the study area.

The mean values for the variables are as shown thus;
$\bar{y}$ = 5.08 kg
$\dot{x}_1$ = 167.25 Naira
$\dot{x}_2$ = 33,190 Naira
$\dot{x}_3$ = 91.50 Naira
$\dot{x}_4$ = 7.6 ≈ 8 individuals
$\dot{x}_5$ = 4

From the above it shows that the mean quantity of breadfruit demanded per household peer month is 55.08kg in the study area.

It can be seen that out of the four functional forms tested, the Semi-log and double log functional form meet the *apriori* sign expectation of their models. Even though the Semi-log functional form

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Table 2: Summary of Estimated Regression Results

	Linear	Semi-log	Double-log	Exponential
Constant	-5.304592	-1.802779	-11.21174	-5.428365
	(-1.44)	(-2.02)	(-2.04)	(-3.55)**
	[3.684244]	[.8914295]	[-11.21174]	[1.529761]
Price (X1)	-0.0310424	-0.0077261	-2.227747	2.20E-113
	(-3.48)**	(-3.58)**	(-3.92)***	(0.72)
	[.0089232]	[.002159]	[.5686913]	[3.1e-113]
Income (X2)	0.0002337	0.0000547	1.761148	.0002301
	(5.48)***	(5.30)***	(-5.32)***	(5.43)***
	[.0000426]	[.0000103]	[.3307621]	[.0000424]
Price of substitute (X3)	-0.0010147	0.0084913	0.7325201	-1.35e-44
	(-0.03)	(-1.14)	(-1.10)	(-0.70)
	[.030732]	[.0074358]	[.2213286]	[1.92e-44]
Household size (X4)	-0.073373	0.0230339	0.1093049	-1.01e-06
	(-0.65)	(-0.84)	(-0.49)	(-0.53)
	[.1133025]	[.0274143]	[.2213286]	[1.93e-06)
Taste (X5)	2.336421	0.4709595	1.821157	.0391398
	(7.84)***	(6.53)***	(6.45)***	(8.75)***
	[.2981946]	[.0721504]	[.2823947]	[.0044746]
R	0.737	0.716	0.7164	0.7087
R2	0.5432	0.5127	0.5132	0.5023
F-ratio	22.34	19.78	19.61	1+8.98

Figures in brackets are't' values while those in parenthesis are 'S.E' values.
**** Highly significant at 1%, **significant at 5%*
Source: Field Survey, 2019

has a lower coefficient of determination at 51.27%, it is selected as the lead equation due to the following:-

- The double log functional form which also meets the *apriori* sign expectation with a slightly higher coefficient of determination of 51.32% showed higher error values for its coefficients.
- The Semi-log functional form has a higher F-Ratio of 19.78 than that of the Double log functional form of 19.61.
- The semi-log functional form meets the statistical and economic expectations of the model

The Semi-log functional form showed three (3) of the independent variables (price (X_1), income (X_2) and taste (X_3)) under study to be significant. X_2 and X_5 were highly significant at 1% while X_1 was significant at 5%. The R^2 value for the Semi-log functional format 51.27% indicates that about 51.27% of the total variations in Y, quantity of African breadfruit demanded in kg, is accounted for or is as a result of the variation in the independent variables.

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4.2 Price elasticity of demand for African breadfruit in the study area

To determine the price elasticity (P.e) for African breadfruit in the study area the formula below used which indicated that: - $P.e = b_n \times (\dot{x}_n/\bar{y}_n)$ ► $P.e = b_1 \times (\dot{x}_1/\bar{y})$

Therefore, P.e = -0.0077261 x (167.25/5.08)

P.e = -0.254

From the research, the negative price elasticity value of -0.254 obtained indicated a negative relationship between the demand for African breadfruit in the study area and the price of the breadfruit.

This appears to agree with the theory of demand that the higher the price of a commodity, the lower the quantity demanded of that commodity. This simply imply that the demand for African breadfruit in the study area is price inelastic since the elasticity value is less than 1 i.e. ***P.e < 1.*** Furthermore, it also indicated that a percent change in the price of breadfruit in the study area leads to a smaller percent change in the quantity of breadfruit demanded.

4.3 Income elasticity of demand for African breadfruit in the study area

In this research, the income elasticity (I.e) of African breadfruit in the study area and as in price elasticity, used formula as shown below where:- $I.e = b_n \times (\dot{x}_n/\bar{y}_n)$ ► $P.e = b_2 \times (\dot{x}_2/\bar{y})$

This imply that, I.e = 0.0000547 x (33190/5.08)

I.e = 0.3574

The above positive elasticity value indicates that there is a positive relationship between quantity of breadfruit demanded and the income of households.

This means that if there is an increase in the income level of households in the study area, one can expect a likely increase in their consumption level of breadfruit.

To interpret income elasticity, the decision rule is as follows;
0 < Income elasticity < 1 = normal good (necessity good)
Income elasticity < 0 = inferior good
Income elasticity > 1 = luxury good

The above computed income elasticity is 0.3574. This indicates that breadfruit is a normal good in the study area and is relatively income inelastic. In other words, it is a necessity good and a part of the livelihood of people in the study area. As their income increase, their demand for African breadfruit also increases but at a lower rate and not in a manner that suggests luxury. This result agrees with research work of Ohajianya and Osuafor (2017).

4.4 Cross-price elasticity of African breadfruit in the study area

For the cross-price elasticity of African breadfruit in the study area the same formula for elasticity was used and the coefficient and mean of X_3 were substituted in the equation as shown thus: - $CP.e = b_n \times (\dot{x}_n/\bar{y}_n)$ ► $CP.e = b_3 \times (\dot{x}_3/\bar{y})$

Therefore, CP.e = 0.0084913 x (91.5/5.08)

CP.e = 0.153

The above positive value for cross-price elasticity indicates a positive relationship between the demand of breadfruit and the price of its substitute. This means that as the price of the substitute increases, the quantity of breadfruit demanded also increases. In determining cross-price elasticity of demand, the decision rule is as follows:-
Cross-price elasticity > 0 = substitute good
Cross-price elasticity < 0 = complementary good

From the research, its findings show that higher cross-price elasticity values indicate that the commodity African breadfruit is readily been substituted with its close substitute good (like cowpea) in the study area.

From the foregoing, it shows that since the cross-price elasticity value is below one (1) but greater than zero, the demand for African breadfruit in the study area is therefore inelastic demand with

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respect to price of its substitute i.e. consumers are relatively unresponsive to changes in the price of its substitute commodity.

Also, since the value is greater than zero (0), it means that cowpea is a substitute food to African breadfruit in the study area. This appears to also agree with Ohajianya and Osuafor (2017).

5.0 Conclusion

The study investigated the potentials demand of African breadfruits by the rural households in Udi agricultural zone of Enugu State, Nigeria. The study shows that the majority of the households in the Udi Local Government of Enugu State are involved in series of activities of African breadfruits enterprises were female and are in the mean age of 34 years. Furthermore, the research results indicated that the price elasticity of the product as -0.254 and this shows that breadfruit is price inelastic in the study area. In addition, the income elasticity of breadfruit in the study area shows - 0.3574 implying that breadfruit is a normal good.

Based on the findings, the study recommends that:
(i) government at all levels should give prioritize promotoion of breadfruit production as a means of livelihood in Enugu State by way of award of grants to rural households that are involved in African breadfruits enterprises and even make provision for hybrid breadfruit seeds for the establishment of breadfruit plantation as a means of preventing its extinction and,
(ii) There is need for the standardization of price of breadfruit as it will limit the present vast price range of breadfruit and make it more affordable to consumers.

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