TECHNICAL EFFICIENCY AND ECONOMIC PERFORMANCE OF LOCUST BEAN (IRU) PRODUCERS IN EKITI STATE, NIGERIA

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Abstract

Locust bean (Iru) is an important nutritional condiment of traditional dishes in Nigeria. This study estimated the technical efficiency and economic performance of locust bean producers; determined the profitability of this enterprise; identified the factors influencing the technical efficiency among locust bean producers and the constraints to locust bean production in Ekiti state. Primary data were collected through a structured questionnaire administered on 100 locust bean producers using a Multistage sampling technique. Descriptive statistics, gross margin analysis, and stochastic frontier production function were used for data analysis. The findings show that the respondents were predominantly female with a mean age of 45years.About 62 percent of the respondents had one level of education or the other while about 38% had no formal education. The average weekly revenue was N9, 614.50k. The gross margin analysis revealed that locust bean is a very lucrative enterprise with a return of N1, 394.50k in the week. However, the mean technical efficiency of locust bean producers was 0.692 while the minimum and maximum efficiency were 0.28 and 0.93 respectively. Efficiency parameters that were significant include; storage cost, cost of pot and income level of respondents. They exhibited positive sign of coefficient. Inefficiency parameters that influence productivity experienced in the business, processing technology and extension services. The major constraints were drudgery, inadequate water supply and lack of government support. It is therefore recommended that locust bean producers could form a viable cooperative so that they can pull their resources together and harness improved technologies.

Key Words: *Technical Efficiency, Economic Performance, and Locust Bean*

INTRODUCTION

Locust bean, otherwise called Iru in Yoruba is an important and economically significant part of African locust bean tree "Parkiabioglobosa" (Ogunwoleet al., 2011; Farayolaet al., 2012). The tree belongs to the family of Fabaceae, subfamily "Mimosoideae" and genus "Parkia". The tree was named after Mungo Park by Robert Brown in 1826. The tree is widely known in West Africa Savannah land as an important multipurpose tree. It tolerates a wide range of alluvial, sandy and lateritic soil, and also resists pest and diseases. It can survive fires and strives in full sun and tropical heat (Farayolaet al., 2012).It produces seeds which are encapsulated in numerous large pods.

The processed seed is used as a condiment for soup. It is an important source of carbohydrate, protein, iron, essential fatty acids, particularly Vitamin B, riboflavin and Vitamin A. (Ajuet al., 2008; Oduroet al., 2007). , The marketing of locust bean is essentially practiced by women as a rural cottage industry. Despite the importance of locust bean in ensuring food security and empowering rural women, its popularity has declined most especially among the growing urban dwellers. This situation is also worsened as a result of an increase in the import of foreign soup flavor. The efficient preservation method for locust bean has led to the necessity to modernize production technique and optimize preservation method by the addition of preservatives. One may even imagine whether the drift from the marketing of locust bean was as a result of the laborious techniques involved in its preservation and marketing vis-à-vis its profitability. This study will unravel this problem.

In the same vein, the average daily intake of locust bean in Nigeria is low which has an estimate of about 1.4% of the daily calories and 5% of the total protein. This has made the marketing and consumption of locust bean to decline in popularity especially among the growing urban population. However, a study in this direction will awaken concerned stakeholders about ensuring efficient marketing of locust bean to save the product from extinction This study will also help prospective entrepreneurs to foresee business opportunities in this direction Hence, the study, estimated the technical efficiency and economic performance of locust bean producers in Ekiti state, Nigeria

Methodology

The study was carried out in Ekiti state. The state lies within the tropics in the rainforest and savannah region of south-western part of Nigeria. It is located between longitude 4045' and 5045' East f Greenwich meridian and latitude 7015' and 805' north of the equator (Carim, 2002). The state enjoys a typical climate with two distinct seasons, the raining season which lasts from April to October and the dry season which prevails for the remaining months. Ekiti State is typically an agrarian state. Primary data were collected from 100 locust bean producers through the aid of a well-structured questionnaire. The respondents were selected using multistage sampling technique. The first stage involves a random selection of fourLocal Government Areas (LGA) while the second stage involves random selectionof five communities from each LGA from 16LGAs in the state. The third stage was the snowball sampling of 5 locust bean producers from each selected community. In all, a total of 100 respondents were interviewed.

Analytical Techniques

Descriptive Statistics

Descriptive statistics like frequency counts and percentages, mean, the standard deviation was used to analyze the socio-economic parameters, the constraints to locust bean production and technical efficiency differentials of locust bean producers in the study area.

Gross Margin Analysis

Gross margin analysis was used to determine the profitability of locust bean enterprise. The equation is given as:

GM = TR - TVC ----------(1)

TR = PXQ - TVC

Where GM = Gross Margin ₦

Q = Quantity of Locust Beans processed (Kg)

P = Price of Processed Locust Beans ₦

Stochastic Frontiers Production Function

Cobb-Douglas stochastic frontier production function was assumed to be the appropriate model for the analysis of the technical efficiency of locust bean producers in Nigeria. The estimated model was given as:

$$\ln Q = \ln \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_n \ln X_{ni} + V_i U_i \quad (2)$$

Where;

Q=Quantity of locust bean processed (Kg)

X_1 = total cash expenditure on labour (in Naira)

X_2 = cost of storage (in Naira)

X_3 =other processing cost (in Naira)

X_4 = cost of bag/sack (in Naira)

X_5 = income from locust bean production (in Naira)

X_6 = price/kg of locust bean seed (in Naira)

X_7 = credit accessibility (access to credit=1, no access to credit=0)

V_i = random errors, which are assumed to be independently and identically distributed as N (0,2v), independently distributed of the U_i

U_i = non-negative random variable, associated with technical efficiency of production, which is assumed to be independently distributed, such that U_i is obtained by trunca tion (at zero) of the normal distribution with variance, μ_2 and mean μ_i where the mean is defined by:

$$\mu_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 \ldots\ldots \delta_n Z_n \quad (3)$$

Where:

δ is a (10 × 1) vector of unknown parameters denoted the coe fficient of technical inefficiency effects. Here negative and positive signs of the parameters reveal that they can increase and decrease farmer's technical efficiency, respectively.

Z_1 = Age (years)

Z_2 = Locust bean processing experience (years)

Z_3 = Educational level (years)

Z_4 = Processing technology (local=0, modern=1)

Z_5 = Access to markets (Yes=1, No=0)

Z_6 = Extension services (Access=1, Non-access=0)

Z_7 = Cooperative membership (Membership=1, Non-membership =0)

Z_8 = Sex (Male=1, Female=0)

Results and Discussion

Socio-Economic Characteristics of Respondents

Table 1 shows that a majority (77%) of the locust bean producers were less than 60years with the mean age of 45years. This implies that the locust bean producers were in their active stage of life. Since traditional processing in agriculture is still characterized by high labour requirement, the respondents in the study area may not face severe labour constraint. All the respondents were female which implies that locust bean production in the study area is predominantly a female enterprise. Also,a majority (94%) of the respondents were married. This distribution favours locust bean production because household members may be used as family labour thereby reducing labour cost. Table 1 further shows that 96% of the respondents had a household size below 8persons with the mean household size of 6persons. Sixty two percent(62%) of the respondents had one level of education or the other while about 38% had no formal education. The observed trend in the level of education of locust bean producers could lead to improved processing techniques and innovations in locust bean processing and production through the adoption of modern methods. Majority (83%) replied on the accumulation of personal savings as the major source of credit. It could be inferred that the source of credit of the respondents is majorly through the informal channel probably due to the cumbersome procedures typical of formal credit sources. Findings also show that 48 percent of the respondents belong to cooperative society. It can be inferred that respondenst who belongs to the co-operative group could come together and pull resources together to achieve a common goal.

Table 1: Socio-economic Characteristics of Respondents

Characteristics	Frequency	Percentages (%)
Age (Years)		
Below 30	13	13.0
31– 40	37	37.0
41 – 50	25	25.0
51- 60	12	(**45)**
Above 60	13	12.0
Total	**100**	13.0
Marital status		**100.0**
Single	3	
Married	94	3.0
Divorced	1	94.0
Widowed	2	1.0
Total	**100**	2.0
Family size (No of Persons)		**100.0**
Below 3	7	
3 – 5	49	7.0
6 – 8	38	49.0
Above 8	6	38.0
Total	**100**	(**5)**
Educational level		6.0
No formal education	38	**100.0**
Adult education	2	
Primary education	22	38.0
Secondary education	34	2.0
Tertiary education	4	22.0
Total	**100**	34.0
Sources of Credit		**4.0**
Personal savings	83	**100.0**
Cooperative society	11	
Banks	2	83.0
Others	4	11.0
Total	10**0**	2.0
		4.0
		100.0

Mean Values in Parentheses

Source:Computed from Field Survey Data, 2014.

Table 2 shows that 15percent of the respondent's process below 11kg per week, 25 percent processed between 11 and 15kg per week, 9 percent (16- 20kg), while about half (51%) processed above 20kg of locust bean per production week. The mean quantity of locust-bean processed was 20.61k. The implication of this is that the locust bean producers operate at a subsistence level. This could be due to traditional method of production and low availability of locust bean seeds.

Table 2: Quantity of Locust Bean Processed by Respondents

Quantity (Kg)	Frequency	Percentages (%)
Below 11	15	15.0
11 - 15	25	25.0
16 - 20	9	9.0
	(20.61)	
21 - 25	24	24.0
Above 25	27	27.0
Total	**100**	**100.0**

Mean Value in Parenthesis
Source: Computed from Field Survey Data, 2014.

From Table 3, 16 percent of the respondents realized below N 5,000 as revenue per week, while the majority (44%) of the respondents had revenue between N 5, 000 and N 10, 000. 25 percent of the respondents' revenue was between N 10, 001 and N 15, 000, while 15 percent were above N 20, 000. The average weekly revenue was N 9614.5000. This implies low income generated from locust being, although commensurate to the quantity produced The low level of production might be due to the lack of processing facilities.

Table 3: Annual Revenue of Respondents

Amount (₦)	Frequency	Percentages (%)
Below 5,000, 000.	16	16.0
5,000,000. – 10,000.	44	44.0**(9,614.50)**
₦10,001 – 15,000	25	25.0
Above 15,0000	15	15.0
Total	**100**	**100.0**

Mean Value in Parenthesis
Source: Computed from Field Survey Data, 2014.

Profitability Analysis of Locust Bean

The profitability analysis of locust bean production/processing is presented in Table 4. The variable cost incurred were sacks, seeds, water, fuel wood and labour. Also, depreciation cost on fixed assets like pot, bowl, and calabash constituted part of the variable cost. The total average variable cost incurred was N14, 816.00 per week. The total output of locust bean constituted those given out and quantity consumed. The total average quantity of locust bean produced per week in the study area was 32.1kg. The minimum price of locust bean produced per kg was N500, while the maximum cost was N600 and the average price per kg was N505.00. The total revenue of the producer was computed to be N16, 219.50 per week. Therefore, the gross margin was N1, 394.50 per week. This implies that the enterprise is profitable to some extent.

Table 4: Profitability Analysis of Locust Bean Production

Item	Minimum	Maximum	Average
Variable Cost			
Sack (No)	100	1200	538.08
Seeds (Kg)	300	16800	5224.23
Depreciation cost (pot) in 10 years lifespan (SLM)	350	3600	1388
Depreciation cost (Bowl) in 2 years lifespan (SLM)	375	7200	2066.69
Depreciation cost (Calabash) in 3 years lifespan (SLM)	333.33	4000	2020
Water (Drum)	200	5000	663
Fuelwood (Load)	100	3000	996
Labour	0	9600	1920
Total Variable Cost			**14816.50**
Revenue	500	600	505
Price of Locust bean per Kg	1000	25200	14998.5
Value of Locust bean sold(Kg)	0	600	353.5
Value of Locust bean consumed (Kg)	0	1200	858.5
Value of Locust bean given as gift (Kg)			**16210.50**
Total Revenue			16210.50 -14816.50
Gross Margin (GM)			**₦1394.50 per week**
GM			

Source: Computed from Field Survey Data, 2014.

Technical efficiency of locust bean production

Table 5 shows the result of stochastic frontiers on locust bean production using frontiers 1.4 according to Baltesse and Coelli (1992).

Efficiency Model

Labour cost had no significant influence on the productivity of locust bean, although, it exhibited negative coefficient, this implies an inverse relationship between productivity and labour cost. Thus, the higher the cost of labour, the lower the productivity derived. This may be due to the fact that locust bean producers lack the resources to contract higher labour that can do the job effectively, unlike farmers relying on family labour. Lack of technical know-how in locust bean processing and production could also be an adduced reason for the inverse relationship between labour and productivity. Cost of storage was significant at 10% level and also exhibited positive coefficient. This implies that the productivity is enhanced as a result of an increase in the cost of storage. This might result from a timely utilization strategy for the production of locust bean whereby during locust bean were stored in off-seasons period to attract higher prices. The cost of pot was significant at 1% level and exhibited positive coefficient. This implies that a unit increase in the cost of pot will increase the processing capacity, so also the output derived and vice versa. The cost of fuelwood, the coefficient of fuelwood was positive but not significant. The positive sign of this variable indicates that the higher the amount expended on fuelwood, the more the productivity derived. The Income level, was significant at 10% level and exhibited positive coefficient. This shows that the higher the income level of locust bean producers, the higher the productivity and vice versa. This means that in the study area, the farmer that earn more income have the resources to process more locust bean. Also, the Price per kg was positive but not significant.

Inefficiency Model

The variables of inefficiency model like age, processing technology and extension services had negative coefficient and were significant at 5% level. This implies that increase in age, processing technology and extension services leads to decrease in the technical inefficiency and consequently increase the technical efficiency of the producer. Other variables include; processing experience, educational level, access to market and cooperative membership had positive coefficient while processing experience was significant at 5% level. This connotes that, the higher the experience, educational level, access to market and cooperative membership, the more the technical inefficiency, of the respondents.

In addition, the estimated sigma square of 0.221 which was significant at 10% level indicated a good fit of the model. The estimated gamma ® of 0.999 obtained indicated that about 90% of the variation in locust bean producers' productivity was due to differences in their practices, and technology used rather than random variability.

Table 5: Result of Regression Analysis

Variables	Parameters	Co-efficient	t-value
Efficiency model			
Constant	β_0	3.97	3.970
Labour (X1)	β_1	-0.00043	-0.310
Storage cost (X2)	β_2	5.699*	4.883
Cost of pot (X3)	β_3	0.5707***	2.6252
Fuelwood (X4)	β_4	0.0589	0.5449
Income (X4)	β_5	2.8297*	3.681
Price/Kg (locust bean) X6	β_6	0.4189	1.7673
Inefficiency model	δ_o		
Constant	δ_1	-0.0081*	0.095
Age (years) Z1	δ_2	-5.648	-1.460
Experience (years) Z2	δ_3	0.9895**	1.9929
Education Z3	δ_4	0.049	2.680
Processing technology Z4	δ_5	-2.098	-3.921
Access to market Z5	δ_6	0.0309	2.006
Extension services Z6	δ_7	-0.6106**	-1.6096
Cooperative membership Z7	$(\delta u^2 + \delta u^2)$	0.087	0.420
Sigma square	$(\delta u^2 / \delta u^2)$	0.221***	9.835
Gamma (r)	$(\delta u / \delta u)$	0.999***	4.674
Lambda		1.877	–
Log-likelihood		–	-0.01319

Source: Computed from Field Survey Data, 2014.

Technical Efficiency of Locust Bean Producers

The distribution of locust bean producers according to their technical efficiency index shows high technical efficiency variations among the farmers (Table 6). It was observed that 12 percent of locust bean farmers were below 0.31 efficiency estimate, 35 percent had a technical efficiency between 0.31 and 0.50, while 46% had technical efficiency index of between 0.51 and 0.70. The remaining respondents (7%) had a technical efficiency above 0.70. Subsequently, the Table shows the mean efficiency of0.692 with minimum and maximum efficiency of 0.28 and 0.93 respectively. The average technical efficiency score of 0.692 implies that an average locust bean producer in the study area could increase productivity by improving technical and allocative efficiency in locust bean production.

Table 6: Technical Efficiency of Respondents

Technical Efficiency	Frequency	Percentages (%)
< 0.31	12	12.0
0.31 – 0.50	35	35.0
0.51 – 0.70	46	46.0
0.71 – 0.90	5	5.0
> 0.90	5	7.0
Total	**100**	**100.0**

Mean Value in Parenthesis **(0.69)**

Source: Computed from Field Survey Data, 2014.

Constraints to Locust Bean Production

The majority (75%) of the respondents complained of drudgery nature of locust bean production, 46% lamented about lackadaisical attitude of the government in supporting them with the provision of the modern processing machine and credit facilities. Another constraint is low market value of the product (35%) in terms of low market price which could discourage the farmers from producing in large quantity. There were complaints from people residing in the surrounding of processing unit about the unpleasant odour of the product which could serve as a constraint to locust bean production, and 15% lamented on lack of storage facilities. However, productivity could be reduced as a result of drudgery in locust bean processing especially the aged women that had no strength to carry out processing activities. Also, 28% complained of inadequate water supply as an important tool affecting locust bean processing, especially during the dry season (see Table 7).

Table 7: Constraints Encountered by Respondents

Problems	Frequency	Percentages (%)
Lack of government support	46	46.0
Drudgery (Labour Intensive)	75	75.0
Inadequate water supply	28	28.0
Product odour	30	30.0
Inadequate extension services	33	33.0
Lack of storage facilities	15	15.0
Low market price of the product	35	35.0

Multiple Responses

Source: Computed from Field Survey Data, 2014.

Conclusion

The technical efficiency estimate from the maximum likelihood signifies that cost of input like pot, fuelwood and income are important factors influencing the efficiency of the respondents. Inefficiency variables that significantly affect productivity were processing experience, processing technology, and extension services. The estimated sigma square of 0.221, though significantly indicated the good fit of the model and estimated gamma (r) of 0.999 implies that 90 percent of the variation in locust bean productivity was due to the differences in their mode of operation or practice. Approximately 70 percent of the respondents were efficient in allocating input in locust bean production.

Recommendations

The following recommendations were made based on the findings;

1. The locust bean processors should be introduced to improved processing technology and provided with the machines at a lower cost.There is a need for an improved method of preservation, packaging, and marketing for the product to meet international standards. Locust bean producers should form a viable cooperative, so as to enhance their mobilization and harmonization of resources.

Government should stimulate extension agents in the agricultural development programme to improve the technical know-how of the locust bean producers through prompt and adequate training

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