NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 50 Number 1, April 2019. Pp.10-16
Available online at: http://www.ajol.info/index.php/naj

TECHNICAL EFFICIENCY AND RETURNS TO SCALE AMONG SMALLHOLDER CASSAVA FARMERS IN OWERRI WEST LGA OF IMO STATE, NIGERIA

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ABSTRACT
This study investigated the technical efficiency and return to scale among smallholder cassava farmers in Owerri West Local Government area of Imo State. Purposive and random sampling techniques were used to select 80 respondents used in the study. Primary data was collected with the use of a well-structured questionnaire and analyzed with both descriptive and inferential statistical tools. The result of the study revealed that majority of the farmers (80%) were males, young and active with mean age of 42 years. About 60% were married, 96.2% of who were literate and on the average had spent 23 years in farming. It was also observed that the farmers had an average household size of 8 members and were mainly smallholder farmers with farm size of 1-2 hectares of land. The result also showed that cassava cuttings had the highest coefficient (0.94) followed by herbicides (0.12) and were highly significant at 1% level and farm size (0.02) and fertilizer(0.06) at 1% alpha level. The result also showed that many of farmers (55%) operated within the technical efficiency range of 0.95-0.99. The elasticity of production of the smallholder cassava farmers was 1.08 indicating increasing returns to scale. The study calls for policies aimed at encouraging education on farm management practices to enable farmers allocate production resources more efficiently for optimum yield. Farmers are also advised to form cooperatives to enable them pull resources together for enhanced economics of scale.

Keywords: Technical Efficiency, Stochastic Frontier Production Function, and Smallholder Cassava

Introduction

The efficiency of production processes has been the focus of attention of economists since the middle of 20th century. In the case of agricultural production, the evaluation of efficiency is especially complicated not only because of the instability of meteorological conditions, but also due to the large variability of farms with respect to their sizes and availability of production data (Lucyna *et al*., 2011). Efficient allocation of resource through the optimum combination of various crop mixtures by small holder farmers to provide food for the family and accumulate monetary income has been evasive in small holder farm economy (Abba & Abu, 2012). According to Tolga *et al* (2010), technical efficiency is defined as the optimal combination of inputs to achieve a given level of output (an input-orientation) or the optimal output that can be produced given a set of inputs (an output orientation). Food production in developing countries has not been able to meet the population pace; hence there is food shortage across the globe (FAO, 2012a). In 2002, cassava suddenly gained prominence in Nigeria following the pronouncement of a presidential initiative on the crop. The initiative was aimed at using cassava production as the engine of growth in Nigeria. Cassava is important not only as food crop but more so as a major source of income for rural household. Cassava production advantage has made the government to encourage its production among resource poor farmers (FAO,2012b). The need to boost cassava production as a means of increasing food supply and reducing rural poverty has continuously been advocated (Adeyemo *et al*, 2010), especially in sub-Saharan Africa where a significant proportion of the rural population is food insecure and malnourished where the attainment of food security is intrinsically linked with reversing agricultural stagnation and safeguarding the National resource base (Matata *et al*, 2008).

Cassava (*Manihot esculenta*) production is vital to the economy of Nigeria as the country is the largest producer of cassava in the world with production of about 45 million metric tonnes (MT) in the world's production of 242 million metric tonnes (MT) in 2009 (PIND, 2011). Cassava production is well developed in Nigeria as an organized agricultural crop. It has well established multiplication and processing techniques for food production and livestock feed, but is gradually increasing especially as import substitution becomes prominent in the industrial sector of the economy (Bifrarin *et al*, 2010). According to Ogunniyi et al (2012), as a food crop, cassava has some inherent characteristics which make it attractive, especially to the smallholder farmers in Nigeria. It is rich in carbohydrates especially starch and consequently has a multiplicity of end users. It is available all year round, making it preferable to other, more seasonal crops such as grains, peas, beans and other crops for food security. Compared to grains, cassava is more tolerant of low soil fertility and more resistant to drought, pests and diseases. The objective of the study was therefore to analyse the technical efficiency and returns to scale among smallholder cassava farmers in Owerri West LGA of Imo State, Nigeria.

Methodology

The study was carried out in Owerri West Local Government Area of Imo State, Nigeria. Imo State has a total population of two million four hundred and eighty five thousand six hundred and thirty five people (2,485, 635) according to National population Census (NPC, 1991). The people of the Local Government Area are predominantly smallholder farmers. They are predominantly arable crop farmers. Crops like cassava, yam, maize etc are grown in Owerri West LGA of Imo state. They also grow vegetables crops such as green (*Amaranthus spp*) water leaf (*Talinum triangulare*), fluted pumpkin (Telferia, occitentalis) tomatoes (*Lycopersicon esculentum*) pepper (*Capsicum annum*) among others. A Multistage random sampling technique was used in the selection of respondents for this study. In stage 1, Five (5) communities namely; Nekede, Obinze, Ihiagwa, Avu and Umuguma was purposely selected due to intensity of cassava production in the area. In stage II, from the four (4) autonomous communities selected, two villages were randomly selected, making a total of 8 villages. In stage III, ten (10) cassava farmers were randomly selected from each of the eight villages. Thus, a total of 80 cassava farmers were randomly selected for the study. From each of the villages, the sampling frames for cassava producers was obtained from the village heads and resident extension agents and organized farmer groups/ associations. Objectives of this study were achieved using descriptive statistics and a cobb-Douglas stochastic frontier production function which was estimated using Maximum Likelihood Estimation (MLE) technique to obtain farm specific technical efficiencies and their determinants.

The stochastic frontier production function is defined by:

$$Y_i = f(X_i,\beta)+\varepsilon_i \qquad (1)$$

Where:

Y_i = Output of i^{th} cassava farmer

X_i = Vector of input quantities of the i^{th} cassava farmer

β = Vector of unknown parameters of the i^{th} cassava farmer

$\varepsilon_i = V_i$-U_i is the composite error term

The two components V_i and U_i are assumed to be independent of each other where, V_i is two sided, normally distributed random error ($V_i \sim N(0,\delta^2 v)$ and U_i are one sided, non-negative variables with a half-normal distribution ($U_i \sim N(0, \delta^2 u)$, which are assumed to account for technical inefficiency in production (Coelli, 2007)

The model variance (δ^2), are related thus:

$\delta^2 = \delta u^2 + \delta v^2$ and the ratio:

$$Y = \frac{\delta u^2}{\delta^2} \qquad (2)$$

Where,

Y = Total output attained on the frontier which is attributed to technical efficiency

δ^2 = constant variance

δv^2 = Variance of the random errors

δu^2 = Technical inefficiency effects

Technical efficiency of an individual farm is defined in terms of the ratio of the observed output (Y_i) to the corresponding frontier output (Y_i^*) given the available technology conditional on the level of inputs used by the farm (Amaza and Maurice, 2005). The technical efficiency of farm will be as follows:

Technical efficiency

$$Y_i / Y_i^* = \frac{f(Xi;\beta)+(V_i - U_i)}{f(Xi;\beta)+V_i} \qquad (3)$$

Where, Y_i = Observed output

Y^* = Frontier output

$V_i - U_i$ = composite error term

β = Vector of unknown parameters

X_i = Vector of input quantities of the i^{th} farmer

The Cobb- Douglas frontier production function is expressed thus:

$$\text{In}Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + V_i - U_i \qquad (4)$$

Where:

In= represent natural logarithm

β_0= intercept

β_1 - β_5 = Unknown parameters to be estimated

Y= Value of output.in kg of the i_{th} farmer

X_1=Total area of farmland under cultivation (ha),

X_2=labour input in man-days,

X_3= Quantity of planting materials (kg)

X_4=fertilizer input (kg),

X_5=capital input in (₦)

V_i = Random error

U_i =Non-negative random variable, representing inefficiency in production relative to the stochastic frontier.

The determinants of technical efficiency are modeled in terms of socio-economic variables of the farmers and estimated jointly with stochastic frontier model in a single stage maximum likelihood estimation procedure:

$$\text{Exp.}(-U_i) = \beta_o + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 + \beta_5 Z_5 + \beta_6 Z_6 \quad (5)$$

Where U_i =Technical inefficiency effect of the i_{th} farm
Z_1=Education (years)
Z_2=farming experience (years)
Z_3= household size (numeric)
Z_4= Gender (dummy variable; 1=male, 0=female)
Z_5=Age (years)
Z_6= Extension contact (dummy variable; 1=yes, 0=no)

Results and Discussion

Socio-economic characteristics of the cassava farmers

Some of the socio-economic characteristics of the cassava farmers are presented in Table 1

Table 1 shows that 8.8% of the farmers were within the age range of 26 – 30 years while 15.0%, 38.8% , 23.8% and 13.8% were within the age range of 31-35, 36-40, 41-45 and above 45 years respectively. This is an indication that the farmers in the study area were mostly middle aged farmers. The implication is that they are energetic and within the active productive work force**.** The result shows that more males (80%) engaged in cassava production than their female counterparts in the study area. This agrees with *a priori* expectation as this enterprise requires more energy and strength which men possess. This also implies that males headed household constituted a greater proportion of those involved in small holder cassava farming in the study area. The finding is in line with Nhemachena and Hassan (2007) who reported that males headed household constituted a greater proportion of those involved in agricultural production. The implication of this may be that productivity is expected to be higher because males have tendency to be more labour efficient. Taking labour efficiency into concern, the finding confirmed the study by Onubuogu *et al.,* (2014) who noted that three women are equivalent to two men.

About 60% of the farmers were married, while 32.5% were single. Also 6.3% and 1.2% of the respondents were widowed and divorced respectively. This implies that the married farmers were more involved in this enterprise in the study area. And this also implies sufficient influence of the family unit in the enterprise. Thus marriage limits migration and enhances labor. This also implies that the married farmers were more involved in this enterprise in the study and also this is an indication of support from their spouse and children in carrying out cassava production activities. This result is in accordance with Gordon and Craig, (2001) who noted that rural household was dominated by married couples. The married are able to take joint decision affecting the farm and the farm households' food security more efficiently. About 78% of the farmers had household size of between 1-10, while; 22% had between11-20. This result shows that the number of people in the household size is of considerable importance in agriculture at the rural area..It is the main source of labour supply for rural farmers as the supply of labour is one of the main inputs in the organization of agricultural activities. The implication of these large household sizes is that there will be more hands to assist in the activities involved in cassava value chain thus having a positive effect not only in reducing the cost of hired labour but also enabling farmers form stronger bond through working in an activity with common goal. This result supports those of Ibekwe *et al* (2013) who asserted that large household size provides most of the labour force for farming households. It has been shown also that decisions are made by the farm family, since the various farming operations are carried out by the members of the family. Also the family size constitutes a major source of labour available in cassava production (Onyenweaku, 1988).

Results show that about 31.3% of the farmers attained secondary level of education while 3.8% had no form of formal education. However, 96.2% of the cassava farmers in the study area were literate with diverse formal educational levels ranging from primary school education to tertiary education. Literacy (ability to read and write) would enable the farmers to better utilize effectively and efficiently available resources in the area. As expected, higher education would enhance improved business ideas, skills, innovation and managerial ability for business sustainability. This result is in agreement with Nwibo and Okorie (2013) and Onyenweaku, (1988) who found out that as an individual increases his educational attainment, his managerial ability for business sustainability also increases. Table 1 also shows that 18.8% of the farmers had farming experience range of 1-10 years, while 50%, 25% and 6.2% had between 11-20, 21-30 and more than 30 years of farming experience respectively. This could be explained by the fact that long years of experience can influence adoption of improved production practices, which invariably requires'

About 5% of the respondents in the study area had farm size of between 0.1-1.0 hectares while 35.0%, 10% and 2.5% had farm size range of 1.1-2.0, 2.1-3.0 and 3.1-4.0 hectares respectively. This result shows that the farmers in the study area were smallholder subsistence farmers. This could be as a result of the fact that land in the study area were commonly owned by members of a family, a village or a clan and as such poses a limiting factor to availability and size of land for agricultural purposes.

Estimated Production Function

The Maximum Likelihood (ML) estimates of the Cobb-Douglas stochastic frontier production parameters for smallholder cassava farmers are presented in Table 2.

Table 2 shows that the signs of the slope coefficients of the stochastic frontier were all positive. This implies that any increase in any of the variables whose coefficient was positive would lead to increase in cassava output. This conforms to *a priori* expectations. All the variables were significant except labour and capital. Specifically, the result shows that cassava cuttings had the highest coefficient (0.94) followed by herbicides (0.12) as both were highly significant at 1% level and farm size (0.02) and fertilizer (.0.06). This implies that 1.0% increase in the use of cassava cuttings, herbicides, farm size and fertilizer would respectively lead to a 0.94%, 0.12%, 0.02% and 0.06% increase in the output of cassava in the study area. The positive and statistical significant nature of these variable inputs suggests that output of the enterprise (cassava) would be positively influenced if more units of these inputs were utilized.

Determinants of Technical Efficiency in Cassava Production

The result shows that the coefficient of age was negatively signed and significant at 5% level. This implies negative relationship with the farmers' technical efficiency. The result also suggests that ageing farmers would be less energetic to work and also less flexible to adopt new technologies for production and this could lead to low productivity as well as low technical efficiency. This conforms to Nwaru (2004), who reported that the ability of a farmer to bear risk and be innovative has been reported to decrease with age. On the other hand, the coefficients of educational level, farming experience, farm size, household size and improved technology were all positive and significant at 1% level, signifying direct relationship with technical efficiency. This is in line with *a priori* expectation as more years of farming experience imply better expertise and the more educated farmer is the better the technical efficiency. Educated farmers are flexible and can adopt good changes and new improved technologies that can enhance their technical efficiency. The estimate of sigma squared (σ^2) was 0.144, and statistically significant and different from zero at 0.01 level, indicating goodness of fit and correctness of distributional assumption specified. The gamma (ϒ) estimated was 0.97 which explained 97% of total variations in cassava output with respect to the sampled farmers. It also measures the effect of technical inefficiency of cassava farmers in the study area.

Technical Efficiency Levels of Smallholder Cassava Farmers in Owerri West Local Government Area, Imo State

The technical efficiency range of farmer in the study has been computed and the results shown in Table 3..The results indicates a great difference in efficiency levels among production units It is appropriate to question why some producers can achieve relatively high efficiency whilst others are technically less efficient. Variation in The technical efficiency of producers is probably due to differences in managerial decisions and farm characteristics that may affect the ability of the producer to adequately use the existing technology.

The results showed that 55% of the farmers operated with the technical efficiency range of 0.95-0.99. The minimum technical efficiency value was 0.82 showing that some farmers were close to the frontier region while some of the farmers were far from the frontier region. The mean technical efficiency value is 0.95 (95%) and shows that there still exists a 5% opportunity for the cassava farmers to improve their current resource efficiency level

Elasticity of Production and Return to Scale for Cassava Farmers

Return to scale was derived through summation of the various elasticities of production for various resources and The return to scale was derived through summation of the elasticities of production for various resources. This gave 1.08 indicating that the cassava farmers were operating at increasing returns to scale. This implies that additional unit of input resulted to a more total product than the preceding unit (Onyebinama, 2000). Thus, the farmers in the study area operated at stage one of the production functions. Thus, they operated at stage one of the production functions (irrational stage). This however shows that various inputs were still underutilized and therefore, it would be ideal for farmers to keep increasing the level of inputs used for output to be maximized.

Conclusion

This study investigated the technical efficiency and return to scale among smallholder cassava farmers in Owerri West Local Government area of Imo State. From the results, all the coefficients of the explanatory variables except those of those of labour and capital have the expected signs and significantly influenced cassava out, indicating that more output would be obtained from the use of additional quantities of these inputs *ceteris paribus*. The result also showed that majority of farmers operated within the technical efficiency range of 0.95-0.99. The elasticity of production of the cassava farmers is 1.08 indicating increasing return to scale implying that additional unit of input resulted to a more total product than the preceding unit. The study therefore calls for policies aimed at subsidizing farm inputs thereby reducing their production cost per hectare to the barest minimum and enhance profitability. Farmers are advised to form cooperatives so that they can pull resources together and thereby reducing subsequent input cost. Access to more education will be crucial in increasing technical efficiency. The need to involve farmers more in the extension process itself should also be encouraged for enhanced efficiency in production.

References

Abba M. W & Abu H.I (2015). Technical efficiency of smallholder rice production rice production in

Adamawa state, Nigeria: *International Conference on Chemical, Food and Environment Engineering* (ICCFEE'15) Jan. 11-12, 2015 Dubai (UAE).

Abba, M.W. (2012) Technical Efficiency of Sorghum Production in Hong Local Government Area of Adamawa State. *Nigeria. Russian Journal of Agricultural and Socio Economic Sciences*, 6 (6).

Adeyemo R.; Oke J.T & Akinola O. (2010). Economic Efficiency of Smallholder farmers in Ogun adoption of improved fallow practices among small holders farm in Western Tanzania. *Humanity and social sciences journal* 2 (1): 63-74.

Ano, A.O. (2003). Studies on the effect of liming on the yield of two cassava cultivars In: NRCRI Annual Report 2003:9

Bifarin .J.O, Ahmi.T., Baruwa.O.I, & Ajewole O.C.(2010) determinants of technical, allocative and economic efficiency in plantain (Musa SPP) production industry, Ondo State, Nigeria International Society for Horticultural Science 879:(199-209)

Coelli, T.J. (2007). Recent development in frontier modelling and efficiency measurement *Australian journal of agricultural economics* 39(3):219-245

Dixon. A.G.O., Akoroda, M., Okechukwu R.U., Ilona, P., Ogbe, F., Egesi, C., Ssemakula, G., L Sanni, J. Lemchi, C. Ezedinma, B. Maziya-Dixon, O. N. Eke-okoro, E. Okoro, A. A. Adeniji, G. Tarawali, and K. Nwosu,C 2006). The Cassava Food Commodity Market and Trade Network and New CMD-resistant cassava varieties released in Nigeria in Nigeria. IITA, Ibadan, Nigeria 296pp

FAO (2012a). FAO STAT. Retrieved July 7, 2017 from FAO Statistics Division 2003: http://faostat3.fao.org/home/index.html#DOWNLOAD

FAO. (2012b). Food and Agricultural Organisation. The statement of food insecurity in the world, Food and Agricultural Organization of the United Nation 2009

FAO/IUSSC. (2006). World Reference Base for Soil Resources. A framework for International Classicification, correlation and communication. Bulletin report no. 103, FAO, Rome. 130pp.

FAO (2014). Food and Agricultural Organization. FAO Cassava Conference 2014. Accessed Online at www.fao.org on 23rd April, 2017

Ibekwe, U., Eze, C., Onyemauwa, C., Henri-Ukoha, A., Korie, O., and Nwaiwu, I. (2013). Determinants of Farm and Off-Farm Income among Farm Households in South East Nigeria. *Academia Arena*, 2(10): 58-61

Iheke, O. R. & Ukaegbu, H. I. 2015. Effect of Poor Health and Farmers' Socioeconomic Variables on Total Factor Productivityof Arable Crop Farm Households in Abia State, Nigeria. Nigerian *Journal of Agriculture, Food and Environment*. 11(3):141-146

IITA (2011). International Institute of Tropical Agriculture, biological control program, in collaboration with USAID and Shell Petroleum Development company in the Cassava Enterprise Development Project (CEDP), from 2004-2011 continues

International Fertilizer Development Centre (2001). Agricultural inputs market in Nigeria. an association and strategy for development pp. 4-*1 Int'l NGO Journal.* 2008;3(4):068-073.

Lucyna Błażejczyk-Majka, Radosław Kala, Krzysztof Maciejewski(2011). Productivity and efficiency of large and small field crop farms and mixed farms of the old and new EU regions'

Matata, P.Z., Ajayi, O.C., Oduol, P.A, and Agumya A(2012). Socioeconomic factors influencing cassava production in Atakunmosa Local Government Area of Osun State. *Prime Journal of Social Science 1: (2):27-30*

Nhemachena, C. & Hassan, R. (2007). *Micro-level analysis of farmers' adaptation to climate change in Southern Africa*. (IFPRI Discussion paper No. 00714). Washington DC,

Nwaru, J. C. (2004). Rural Credit Markets and Resource Use in Arable Crop Production in Imo State of Nigeria.PhD Thesis Michael Okpara University of Agriculture, Umudike

Nwibo, S U. and Okorie, A (2013). Determinants of Entrepreneurship among Agribusiness Investors In South-East, Nigeria. *European J. Bus. Mgt*. 5(10):115-123

Ogunniy L.T., Ajao A.O., Olapade – Ogunwole F., and Ganiyu M. O., (2012). Resources use efficiency of cassava production in Atakunmosa Local Government Area of Osun State. *Prime Journal of Social Science*, 1: (2): 27-30

Onubuogu. G. C., Chidebelu, S, A. N. D. and Eboh, E. C. (2013). Enterprise Type, Size and Allocative Efficiency of Broiler Production in Imo State, Nigeria. *International Journal of Applied Research and Technology.* 2(6): 10 – 19.

Onyebinama U.A.U (2000) *Economic and production management for agriculture*, Nigeria Owerri, Alphabet publishers pg 86-89, 90-99

Onyenweaku, C.E. (1988) rural development through stimulating the adoption of improved technology by farmers in Imo state. *Paper presented at NTA/IMSU. Second annual seminar on rural development Imo state university*, Okigwe (Nov.1988, P.1-12) IMSU now Abia State University Uturu

Tolga, T., Nural, Y., Mehmet, N. and Bahattin, Ç. (2010). *Measuring the technical efficiency and determinants of efficiency of rice (Oryza sativa) farms in Marmara region, Turkey,New Zealand.* Journal of Crop and Horticultural Science ISSN: 0114-0671 (Print)1175-8783 (Online) Journal homepage: http://www.tandfonline.com/loi/tnzc20

Table 1: socio-economic characteristics of the cassava farmers

Age (years)	Frequency	Percentage
26 – 30	7	8.8
31 – 35	12	15.0
36 – 40	31	38.8
41 – 45	19	23.8
> 45	11	13.8
Mean: 42		
Total	80	100
Gender		
Male	64	80
Female	16	20
Total	80	100
Marital status		
Single	26	32.5
Married	48	60
Widowed	5	6.3
Divorced	1	1.2
Total	80	100
Household size		
1-10	62	78
11-20	18	22
Mean: 8		
Total	80	100
Educational attainment		
Primary	25	31.3
Secondary	37	46.3
Tertiary	15	18.8
No formal education	3	3.8
Total	80	100
Farm size(ha)		
0.1-1.0	42	52.5
1.1-2.0	28	35.0
2.1-3.0	8	10
3.1-4.0	2	2.5
Total	80	100

Source: Field Survey, 2017

Table 2 Maximum Likelihood Estimation of the Cobb – Douglas Stochastic Production Frontier For Cassava Farmers

Production factors	Parameters	Estimated coefficient	Standard error	t - value
Constant term	X_0	4.1269	0.9936	4.1540***
Farm size	X_1	0.0196	45.0864	4.3418***
Cuttings	X_2	0.9412	0.0891	10.5604***
Labour	X_3	0.0161	0.1448	0.1114
Fertilizer	X_4	0.0647	0.0070	9.2395***
Herbicides	X_5	0.0125	0.0078	16.0736***
Capital	X_6	0.0283	0.0143	0.1981
Efficiency factors				
Constant term	Z_0	-0.0122	0.9222	-0.0132
Age	Z_1	-0.0027	0.0013	-2.1338*
Educational level	Z_2	0.0125	0.0010	12.0443***
Farming experience	Z_3	0.0439	0.0035	12.4960***
Farm size	Z_4	0.0105	0.0032	3.2890***
Credit access	Z_5	-0.0122	0.9222	-0.0132
Cooperative membership	Z_6	-0.0164	0.1382	-0.1189
Household size	Z_7	0.1131	0.0086	13.0780***
Improved technology	Z_8	0.0118	0.0046	2.5560***
Sigma squared	σ^2	0.1449	0.0124	36.2830***
Gamma	Υ	0.9715	0.0096	14.6834***

Source: Field survey data, 2017. (*) = significance at 10%. (**) = significance at 5%; (***) = significance at 1%

Table 3: Distribution of cassava farmers according to Technical Efficiency levels

Range of technical efficiency	Frequency	Percentage (%)
0.80 - 0.84	2	2.5
0.85 – 0.89	14	17.5
0.90 – 0.94	20	25.0
0.95 – 0.99	44	55.0
Total	80	100

Maximum technical efficiency = 0.99
Minimum technical efficiency = 0.82
Mean technical efficiency = 0.95
Source: Field Survey data, 2017

Table 4 Elasticity of Production (ER)

Variables	Elasticity
Farm size	0.0196
Cuttings	0.9412
Labour	0.0161
Fertilizer	0.0647
Herbicides	0.0125
Capital	0.0283
Sum Elasticity	1.08

Source: Field Survey data, 2017