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Allocative Efficiency of TMS (Tropical Manihot Selection) Cassava Production in Ebonyi State, Nigeria

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Abstract

This study investigated the allocative efficiency of TMS (Tropical Manihot Selection) cassava production in Ebonyi State, Nigeria. One hundred and twenty respondents were selected from twelve villages using multi-stage sampling technique. Data were collected using a well-structured questionnaire. Descriptive statistics, and allocative efficiency, elastcity of production and returns to scale models were used for data analyses. Farm land (77218.0), cassava cuttings (2.30), labour (71.283) and capital (-6.524) were under-utilized, while fertilizer (0.616) was over-utilized. The return to scale of the cassava farmers was 1.324. Policies were recommended that will enhance increased use of farm land, cassava cuttings, farm labour and capital, while decreasing the use of fertilizer in TMS cassava production.

Keywords: Allocative efficiency, TMS cassava, Ebonyi State

Introduction

One of the major hindrances to rural development in sub-Saharan Africa (SSA), including Nigeria is poverty. In the region, agriculture is the major occupation, and policy options geared towards growth of agriculture are best-bet strategies for poverty alleviation (Okoye and Onyenweaku, 2007; Oyewole and Eforuku, 2019). An increase in agricultural productivity, as asserted by Kolapo and Abimbola, (2020) has the capacity to lessen poverty by enhancing farmers' income and thus, resulting in boosts in consumption. Among popular crops grown in the region as powerful poverty fighters is cassava, which has gained wide pre-eminence among smallholder farmers (FAO, 2018). Cassava has intrinsic features which enables it play vital role to the food security of the rural people. This stems from its capabilities to produce reasonable levels of output under marginal soil conditions, tolerance to drought, low cash input, adaptation to wide ecological zones, high energy per hectare compare to other staple crops, all year round availability, adaptability to several farming systems, and tolerance to adverse weather, pests and diseases (Esheya, 2019).

Cassava is one of the important and extensively grown food crops in Nigeria and is the staple food for more than half of the African population. Consumption of cassava by most households in Nigeria, especially in the South-east is in the processed forms such as *gari, fufu*, fresh and dry flakes (*abacha)* and *tapioca* (Ibekwe, Orebiyi, Henri-Ukoha, Okorji, Nwagbo, and Chidiebere-Mark, 2012). In addition, FAO (2019) reported that cassava serves as cash crop to farmers in the producing areas in the country, as about 45% of it is sold to meet family needs. Apart from human consumption and cash income purposes, cassava could be used as livestock feed and for industrial purposes (e.g. plywood, textile and bakery industries, and cassava starch for pharmaceutical, industrial alcohol, processed foods and laundry industries). Among the varieties of cassava that are gaining wide acceptance is Tropical Manihot Selection (TMS). This variety was developed by the International Institute for Tropical Agriculture (IITA) and National Root Crop Research Institute (NRCRI) in collaboration with the government of Federal Republic of Nigeria (Ume *et al*. 2020). The TMS variety exists under diverse cultivars such as TMS: 50395, 63397, 30555, 4(2)1425, 30211 and 30572 (Ogunleye, Bamire & Awolola, 2019). They have remarkable features including tolerance to Cassava mosaic disease (CMD) and Cassava Spider mite (CSM), low cyanide content, drought resistance, early maturing, and high yielding (Shittu, Alimi, Wahab, Sanni, and Abass, 2016).

In 2018, global production of cassava stood at more than 278 million tons, of which Africa produced 170 million, accounting for over 56%. In the same year, Nigeria produced 60 million tons, standing out as world's largest producer (FAO, 2019). The growth in cassava production in Nigeria has been primarily due to rapid population growth, availability of high yielding improved varieties of cassava, well-developed market access infrastructure, the presence of improved processing technology, well-organized internal market structure and efforts of NRCRI and IITA through research in varied areas to boast cassava production (Oyewole and Eforuku, 2019). Nevertheless, despite the large cassava production in the country, its productivity has remained abysmally low at 7.7 metric tonnes per hectare, compared to 23.4 metric tonnes/ha and 22.2 metric tonnes/ha in Indonesia and Thailand, respectively (FAO, 2019). Low cassava productivity in the country could be enhanced through increased efficiency in resource use. Efficiency in resource utilization is associated with the possibility of attaining optimal level of output from a given level of input (Gani and Omonoma, 2012).

Efficiency could be technical or allocative, however, the combination of the two results to economic efficiency (Ume *et al.,* 2020). However, for this study, attention is focused on allocative efficiency. Allocative efficiency as asserted by Okoye, Asumugba, and Onwubiko (2015) is the management of available scarce resources and technical know-how to attain the highest probable economic gain within given resources. More so, Ubokudom, Esheya and Udioko (2021) relate allocative efficiency as the ratio of the technically maximum output at the farmer's level of resources to the output obtainable at the optimum level of resources. It is imperative to state that literature showed that for cassava production to flourish, it desires to attain among others high level of allocative efficiency which is indispensable for improving nutrition, enhance food security, create employment opportunities and improve the efficiency of utilization of labour (Reincke, Vilvert, Fasse, Graef, Sieber, and Lana, 2018).

Unfortunately, the issue of allocative efficiency is a great concern in Ebonyi state. Ebonyi is currently one of the largest producers of cassava in Nigeria, but the trend in yield performance (production per hectare) remains low. This low yield may be linked to ineffective agronomic practices and inefficient management of production resources. This has largely contributed to poor performance of the agricultural sector in terms of efficient use of productive resources (Tadele and Assefa, 2012). It is against this background that this study was undertaken to examine the allocative efficiency of resource use among farmers of TMS cassava varieties' in Ebonyi State, Nigeria. Specifically, the objectives were to: determine the allocative efficiencies of TMS cassava production; their elasticity and returns to scale.

Methodology

The study was conducted in Ebonyi State, South-east Nigeria. Ebonyi State is located within latitudes $5^0 40'$ and $6^0 45'$ North of the Equator and longitudes $7^0 38'$ and $8^0 30'$ east of the Greenwich Meridian and it shares boundaries with Cross River, Abia, Enugu and Benue States in the east, south, west and north respectively (EBSG, 2003). Its total land area is 5,533km^2 (NPC, 2006). Ebonyi state consists of 13 Local Government Areas (LGAs) in three agricultural zones, with the capital at Abakaliki. The State has an annual temperature range of 23^oC to 40^oC, and annual humidity of 72.2% at 0900 GMT. The primary occupation in the State is agriculture, involving the cultivation of crops such rice, yam, cassava, cocoyam, and vegetables. Livestock such as sheep, goat, rabbit, cow, pig, and chickens are also reared. Other common occupations in the state included civil servants, hair barbing and plating salons, artisans, mason, tailoring, automobile mechanics, driving, and trading, among others (Esheya, 2012). Multi-stage sampling technique was used to select 120 respondents for the study. In the first stage, two agricultural zones were purposively selected, because of wide scale adoption of TMS cassava in the area. The selected zones were Ebonyi South and Ebonyi North. In the second stage, one LGA was purposively selected from each of the selected agricultural zones. The selected LGAs were Ohaukwu in Ebonyi North and Ivo in Ebonyi South agricultural zones. In stage three, six communities were selected from each of the selected LGAs, making a total of 12 communities. In the last stage, ten TMS cassava farmers were randomly selected from each of the selected communities, using the lists of TMS cassava farmers obtained from extension agents and local leaders in the areas. Primary information were used in the study. Data were analyzed using descriptive statistics, allocative efficiency, elasticity and return to scale models. The Stochastic Frontier Production function (SFPF) using the Cobb-Douglas functional form was used to determine the production function in this study. The production function model was explicitly specified in its linear form as:

$$\ln Y_1 = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \varepsilon \quad \ldots\ldots\ldots(1)$$

Where,
ln = natural logarithm
Y = value of cassava output (N)
x_1 = farm size (ha),
x_2 = labour (mandays)
x_3 = cassava stem (bundle)
x_4 = fertilizer (kg)
x_5 = capital (N)
$\beta_1 - \beta_5$ = coefficient of the parameters to be estimated
εi = error term,
β_0 = intercept.

Allocative efficiency model

The estimated coefficients of the relevant independent variables were used to compute the Marginal Value Products (MVP) and their corresponding Marginal Factor Costs (MFC). The equation is:

r=MVP/MFC….. (2)

Where,
r = efficiency ratio
MVP = Marginal Value Product of variable input

MFC = Marginal Factor Cost

The value of MVP was computed using the regression coefficient of each input of TMS cassava varieties and the price of the TMS cassava output was expressed as stated thus:

MVPx= bi × Py …….(3)

Where,
Py = price per unit of output
bi = regression coefficient of input i (I = 1, 2,...n)

MVPxi = Marginal Value Product of input xi.

The prevailing market price of TMS cassava inputs was used as the Marginal Factor Cost (MFC). The values of the ratios are interpreted thus:

i. If r < 1, implies that the resource was over-utilized- hence signifying that increment of the resource in question will boost the profitability of TMS cassava.

ii. If r > 1, means under-utilization of the resource. The implication is that there is inverse relationship between the said resource and profit.

iii. If r = 1, implies efficient of resource use.

Elasticity of Production and Return to Scale Models

The elasticity of production which is the degree of responsiveness of the output to a unit change in input used was computed using the Cobb Douglas function. The coefficients of the independent variable (Xi) of the Cobb Douglas function were the direct elasticities of production. The value of the elasticity indicated whether each additional input used results in constant (Ep=1), increasing (Ep>1) or decreasing (Ep<1) productivity. The sum of the individual elasticities gave the rate of return to production and indicates the stage of production (that is whether stage 1, 2 or 3) where the respondent is operating (Ikezor and Alufohai, 2014).

Results and Discussion

Allocative Efficiency of TMS Cassava Farmers

The allocative efficiency of TMS cassava farmers is shown in Table 1. The coefficients of double log (Cobb-Douglas) functional form was used to compute the allocative efficiency indices (β_1-β_5). The ratios of the marginal value product (MVP) of each factor input to their respective acquisition cost were computed to obtain the allocative efficiency of the TMS cassava farmers. The result indicated that none of the variables considered had efficiency ratio that is equal to 1 (one). The ratios of the marginal value product to marginal factor cost of labour (71.283) and cassava cutting (2.3) were greater than 1, signifying under-utilization of resources. This implies that the resource inputs were used at less than optimum profit level. So, increasing the level of use of the resources will lead to profit optimization (Wilcox, Ugwumba, Achike, Agbagwaa, and Uche, 2016). Ume *et al.* (2020) was in agreement to these assertions but Okoye, Asumugha, and Onwubiko (2015) contradicted that in their study and reported that the employment of large number of labour in a small sized farm could result to over-utilization. The under-utilization of resources could be correlated to unavailability and high cost of improved varieties of cassava (Wossen, Tessema, Abdoulaye, Rabbi, Olanrewaju, Alene, Feleke, Kulakow, Asumugha, Adebayo, and Manyong, 2017). The effects of under-utilization of resources are that farming remains in rudimentary and traditional levels (FAO, 2019; FAO, 2018).

The over-utilized resources as shown in the Table were farm size (-29.05), fertilizer (-62.33) and capital (-99.9), implying that less of the profit maximization of the resource was used. The possible reasons for the over utilization of the resources of fertilizer and labour could be due to uncontrolled use of farm yard manure from their animal houses and extensive use of family manual labour supply. Therefore, for profit to be optimized in cassava production, labour and cassava cutting should be increased from current level by 1.4% and 43.5%, while fertilizer, farm size and capital should be decreased from their current levels by -62.33%, 29.5% and -99.9% respectively.

Elasticity of production and return to scale of cassava

The elasticity of production and return to scale of TMS cassava farmers is shown in Table 2. The elasticity of production shows the change in output relative to unit change in input. The returns to scale of the farms were derived through summation of the elasticity of production for various inputs (Mbanasor and Obioha, 2003). The result showed that elasticities for farm size, cassava cuttings, fertiliser, labour and capital were: 0.615, 0.473, -0.108, 0.182 and 0.162 respectively. The elasticities less than unity were estimated to be positive decreasing functions indicating that the allocation and utilisation of the variables were in stage of economic relevance at the production function (Stage II). The elasticity for fertiliser (-0.108) less than zero showed a negative decreasing function to the factors, indicating the over-utilization of the input, implying that its allocation and utilisation were at the irrational stage of production (stage III) of the production process.

The returns to scale was 1.324, which was an indication that TMS cassava production in the study area was in stage 1, implying that inputs were under-utilized by the TMS cassava farmers. This indicates that the farmers were operating in stage one of the production process, i.e., the increasing returns segment of the production function. This is an irrational stage of the production function because addition of a unit input gives more than proportionate output. Output cannot be optimized here and therefore, production has to be increased. Ume *et al.* (2018) reported that farmers they studied had the same returns to scale. They inferred that increasing returns could occur in relatively low levels of output that characterized small scale farming, on whose productivity can be enhanced by employing more of improved inputs. This suggested that TMS cassava farmers could benefit from the economies of scale linked to increasing returns.

Conclusion

The study investigated the allocative efficiency of TMS cassava production in Ebonyi State, Nigeria. The farmers were allocatively inefficient. The result of the allocative efficiency showed that none of the respondents achieved absolute efficiency of resource use as they either underutilized or over utilized the farm resources. The over utilized resources were fertilizer, farm size and capital, while the underutilized resources were cassava stem cuttings and labour. This showed that none of the production inputs was optimally allocated and utilized. The returns to scale of the cassava farmers was 1.324, indicating that the farmers were producing at stage one of the production function. The overall productivity of TMS cassava was however in the irrational stage of production (stage I) suggesting that there was room for expansion in output and productivity. The study recommends policies that will ensure increased utilization of farm lands, labour, cassava cuttings and capital in TMS cassava production, while the use of fertilizer should be decreased. There is need therefore for training and re-training of extension agents on improved production and management practices to enable them disseminate same to farmers on the need to use available resources efficiently. Government should encourage policies that will ensure increased utilization of farm lands, labour, cassava cuttings and capital in TMS cassava production, while the use of fertilizer should be decreased. Since the under-utilsation of some of the resources may not be unconnected with inadequate capital, the TMS cassava farmers should be assisted to organize themselves into groups/ cooperatives in order to access more funds.

Table 1: Allocative efficiency of TMS cassava farmers

Variable	$\overline{Y}$	$\overline{X}$	Bi	MPP	MVP	MFC	R	(D)%
Farm size	2,350	0.357	0.615	1290.20	129020	2000	64.51.	-29.5
Cassava cutting	2,350	340	O.473	6.911	345.55	150	2.30	43.5
Fertilizer	2,350	420	-0.108	2.647	132.35	220	0.602	-62.33
Labour	2,350	600	0.182	712.833	142566	2000	71.283	1.4
Capital	2,350	-214	0.162	2135.8	-65247	1000	-65.525	-99.9

Source: Field Survey, 2021

Key:

MPP = M*arginal Physical Product*

MVP = M*arginal Value Product*

MFC = M*arginal Factor Cost*

Table 2: Elasticity of production and return to scale of TMS cassava farmers

Variable	Elasticity of Production
Farm size	0.615
Cassava cuttings	0.473
Fertilizer	-0.108
Labour	0.182
Capital	0.162
Return to Scale	1.324

Source: Field Survey, 2021

References

Okoye, B. C., Asumugba, G.N. and Onwubiko, A. and (2015). Allocative efficiency of small holder cocoyam farmers in Anambra State, Nigeria. *The Nigeria Agricultural Journal, 38*: 70-81.

EBSG (2003). Ebonyi State Government. Ebonyi in brief. A publication of the ministry of information, Abakaliki, Ebonyi State.

Esheya, S. E. (2012). Economic effects of limestone exploitation on crop production in Ebonyi State. *International Journal of Agricultural Economics, Management and Development*, *2*: 124-144.

Esheya, S.E. (2019). Economics of cassava production in Ohaukwu local government area of Ebonyi State, Nigeria. *Akwa-Ibom State University Journal of Agricultural Economics, Extension and Rural Development,* 2 (2): 92 – 98.

FAO (2018). Annual bulletin. Food and Agriculture Organization (FAO) website. www.fao.org.

FAO (2019). Annual bulletin. Food and Agriculture Organization (FAO) website. www.fao.org.

Gani, B.S. and Omonona, B.T. (2012). Resource use efficiency among small-scale irrigated maize producers in Northern Taraba State of Nigeria.

Journal of Human Ecology, 28(2): 113–119.

Ibekwe, U. C., Orebiyi, J.S., Henri-Ukoha, I. A., Okorji, E. C., Nwagbo, E. C. and Chidiebere-Mark, N. M. (2012). Resource use efficiency in cassava production in South East Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology, 1(1): 16-21.*

Izekor, O.B. and. Alufohai G.O. (2014). Production elasticities, return to scale and allocative efficiency in yam production in Edo state, Nigeria. *Agrosearch*, 14(2):179-190.

Kolapo, A. and Abimbola, E.I. (2020). Consumers' preferences and willingness to pay for bioFortified vitamin-A garri in South Western, Nigeria: A conjoint analysis and double-hurdle model estimation. *World Research Journal of Agricultural Sciences*, 7(2): 221-229.

Mbanasor, J. A. and Obiora, I. O. (2005). Resource productivity under FADAMA cropping system in Umuahia North Local Government Area of Abia State, Nigeria. *Journal of Tropical and Subtropical Agro-ecosystem, 2: 81-36.*

Nnadozie, A.K.O., Ume, S.I., Isiocha, S. and Njoku, I. A. (2015). Nigerian cassava potentials in National Economic Development. *Science Journal of Business Management, 3*(5): 47-49.

NPC (2006). National population commission. The 2006 national population census result. Published by NPC Headquarters, Abuja, Nigeria.

Ogunleye, A.S., Bamire, A.S. and Awolola, O. (2019). Profitability of investment and farm level efficiency among groups of vitamin A cassava farmers in Oyo State Nigeria. *American Journal of Environmental and Resource Economics, 8*(1): 14-19.

Okoye, B.C. and Onyenweaku, C.E. (2007). Economic efficiency of small holder cocoyam farmers in Anamabra State, Nigeria: A Trans-log stochastic frontier cost function approach. *Medwell Journals,* 4:535-546.

Otekunrin, O.A. and Sawicka, B. (2019). Cassava, a 21st century staple crop: How can Nigeria harness its enormous trade potentials? *African Scientific Agriculture, 3*(8): 194-202.

Oyewole, M.F. and Eforuoku, F. (2019). Value addition on cassava waste among processors in Oyo State, Nigeria. *Journal of Agricultural Extension, 23*(3):135-146.

Reincke, K., Vilvert, E., Fasse, A., Graef, F., Sieber, S. and Lana, M.A. (2018). Key factors influencing food security of smallholder farmers in Tanzania and the role of cassava as a strategic crop. *Journal of Food Security, 10*(4): 911-924.

Shittu, T.A., Alimi, B.A., Wahab, B., Sanni, L.O. and Abass, A.B. (2016). Cassava flour and starch: Processing technology and utilisation. In: Sharma, H.K., Njintang, N.Y., Singhal, R.S. and Kaushal, P. (Eds.). *Tropical roots and tubers production, processing and technology*. New York: John Wiley and Sons Limited.

Tadele, Z. and Assefa K. (2012). Increasing food production in Africa by boosting the productivity of understudied crops. *Journal of agronomy,* 2(4): 240–283.

Ubokudom, E. O., Esheya, S. E. and Udioko G. U. (2021). Profitability of Biofortified Yellow Cassava Farming in Nigeria: Empirical Evidence from Akwa Ibom State. *Akwa-Ibom State University Journal of Agriculture and Food Sciences,* 5 (2): 100-112.

Ume, S I., Nweke, J., Ucha, S. and Idahosa, S. J. (2018). Allocative efficiency in okra (Abelmoschus Spp.) production in Ayamelum Local Government Area of Anambra State, Nigeria. *Archives of Current Research International;* 15(1): 1-7.

Ume, S.I., Onwujiariri, U.J. and Nwaneri, T.C. (2020). Effect of cassava processing to the environment in South East, Nigeria - Implication on adoption of cassava processing technology. *Journal of Sustainable Food Production,* 9: 1-14.

Wilcox, G. I., Ugwumba, C. O. A., Achike A. I., Agbagwaa, C. and Uche, F.B. (2016). Allocative efficiency *and socio-economic determinants of allocative efficiency cocoyam production among smallholder farmers in South-South Nigeria*. International Journal of Environmental & Agriculture Research (IJOEAR); 2 (9): 57- 67.

Wossen, O.T., Tessema, T., Abdoulaye, I., Rabbi, A., Olanrewaju, A., Alene, S., Feleke, P., Kulakow, G., Asumugha, A., Adebayo, A. and Manyong, V. (2017). The cassava monitoring survey in Nigeria: Final report. IITA, Ibadan, Nigeria. ISBN 978-978-8444-81-7: 66.