Analysis of Farmland Value Systems and Productivity of Cassava in Ecologically Vulnerable Areas of Imo State, Nigeria

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Abstract

This study analyzed farmland value systems and productivity of cassava in ecologically vulnerable areas of Imo State, Nigeria. The study estimated productivity of farmland systems and factors affecting them, and farmland suitability. Data were collected with questionnaire from 360 randomly selected cassava farmers and analyzed using descriptive statistics, suitability model, productivity model, and multiple regression techniques. Farmland suitability index ranges from 0.107 to 0.712 with a mean of 0.493. Majority (62.4%) of the cassava farmers cultivate on non-suitable farmlands, 33.7% of them cultivate on marginally suitable farmlands, while 3.9% of them cultivate on suitable farmlands. Productivity of farmland were 1.38, 2.00 and 3.16 for non-suitable, marginally suitable and suitable value systems respectively, indicating that marginally suitable and suitable farmlands were higher in productivity than non-suitable farmlands. Land rent, quantity of fertilizer, and household size have significant and negative effect on non-suitable farmland productivity. Farm size, land rent, fertilizer applied, education and extension have significant effect on marginally suitable farmlands productivity. Farm size, fertilizer, farming experience and household size significantly affect suitable farmland productivity. Farmers cultivating suitable farmlands should increase their cassava output and improve their farm income through allocation of more production resources to cassava production in an optimal manner.

Keywords Farmland, Suitability, Productivity, Ecologically Vulnerable, Cassava, Farmers.
JEL code Agricultural Economics, Q1

INTRODUCTION

Farmland is the area of the earth surface devoted to agricultural production. It is prone to ecological vulnerability in most parts of Imo state, Nigeria due to the influence of some natural and human factors that account for its value and productivity of cultivated crops (Verheye, 1999; Okere, 2012). The vagaries of nature such as bad weather conditions, pests and diseases, flood, thunderstorm, erosion and fire outbreaks; and human activities which include bush burning, continuous cropping and deforestation have continued to put much environmental pressure on farmland resulting in loss of nutrient, late planting, marginal farmland value, intensification of farmland and decline in farm output (Eswaran, 2001; Bassey, 2008).

Cassava is known to adapt even in unsuitable and marginally suitable farmlands but its productivity differs on the different classes of farmland values (Korie *et.al*., 2006; Okere, 2012). Cassava productivity is the ratio of cassava output per unit of input used in the production process (Oyekale, 2008). A low quality farmland may not support increasing cassava output over years; hence output of cassava on marginally suitable farmland can hardly sustain the increasing population of farm households nor meet the food security initiatives of Imo state, Nigeria. Hence, a suitable farmland is put under pressure of continuous cropping while the marginally suitable and unsuitable farmlands have continued to loss their fertility (Ehirim et.al., 2006; Korie *et.al.*,2006)

Despite the fact that cassava grows in marginally suitable fertility condition, its productivity declines with the quality of farmland (Korie *et.al., 2006;* Okere, 2012). Productivity differentials of cassava on different classes of farmland as found in other parts of the world is a strong evidence that marginally suitable and unsuitable farmlands may lead to severe farm household poverty in the near future (Beak, 1979; Verheye, 2001; Eswaran, 2001) and this is a cause for serious concern to policy makers and researchers in Imo state, Nigeria coupled with the fact that previous studies in Imo state that focused on the productivity of cassava under different farmland value systems are very scanty. Therefore, this study determined farmland suitability, estimated productivity of different farmland value systems, and determined the factors affecting productivity of different farmland value systems in Imo state, Nigeria.

METHODS AND MATERIALS

This study was conducted in the ecologically vulnerable areas of Imo state, Nigeria. The state is composed of three agricultural zones of Owerri, Orlu and Okigwe and subdivided into 27 Local Government Areas (LGAs). The ecologically vulnerable areas of Imo state according to the Department of Erosion Control, Ministry of Petroleum and Environment, Owerri, Imo state (2006) include Owerri West, Mbaitoli, Ikeduru, Aboh Mbaise, Oweri North, Ahiazu Mbaise, and Ezinihitte Mbaise LGAs from Owerri agricultural zone; Obowo, Ehime Mbano, Ihitte Uboma and Isiala Mbano LGAs from Okigwe agricultural zone; while Orlu agricultural zone has Orlu, Isu, Njaba, Ideato North, Ideato South, and Orsu LGAs. Farming is the dorminant occupation of the people, and major crops grown include cassava, yam, cocoyam, maize, and vegetables.

A purposive selection of two LGAs from each agricultural zone was made to ensure that only those areas known for cassava production and with intensity of ecological vulnerability were sampled.

One village was randomly selected from each of the six LGAs, making a total of six villages. The sampling frame was the list of cassava farmers in the selected villages. From this list totaling 635 farmers, a sample size of 360 cassava farmers were proportionately and randomly selected for the study.

Data were collected with validated questionnaire in 2013, and analyzed using descriptive statistics (mean, frequency distribution and percentages), suitability model, productivity model, and multiple regression techniques.

Farmland suitability was determined using suitability model specified as follows;

$$S_1 = \frac{V_i}{\overline{N}} \quad (O < \underline{S}_1 < \underline{I}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

S_1 = Suitability index (the ratio of actual number of positive farmland management activities and the number of avoidance of negative externalities by an ith farmer).

V_i = Actual number of positive farmland management practices and number of negative externalities avoidable by an ith farmer in the area.

N = The aggregate list of both farmland management activities that farmers responded yes and the negative externalities farmers responded No to in the study area.

As S_1 approaches I ($S_1 \geq 0.65$), then farmland is very suitable for cassava production. If S_1 falls between 0.5 and 0.64, then farmland is marginally suitable, but if S_1 approaches 0 ($S_1 < 0.5$), then the farmland is non-suitable for cassava production (Olowu and Oladeji; 2004; Okere, 2012).

Productivity of different farmland value systems were estimated using productivity model which according to Olayide and Heady (1982) and Dixon (1990) is specified as;

$$A_i = \frac{Y_i}{L_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where,

A_i = Productivity of ith class of farmland

Y_i = Output or total returns of cassava and cassava products from an ith class of farmland (₦)

L_i = Total rent and cost of land improvement in each class of farmland (₦)

Factors affecting productivity of different farmland value systems were determined using multiple regression model specified implicitly as follows;

$LPt_i = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, e)$ ……..(3)

Where,

LPt_i = Productivity of an ith class of farmland in the area.

X_1 = Farm size (Ha)

X_2 = Rent on land (₦)

X_3 = Quantity of fertilizer applied (kg)

X_4 = Quantity of agro-chemicals applied (liters)

X_5 = Distance to farmer's home (km)

X_6 = Level of education (number of years spent in school)

X_7 = Farming experience (years)

X_8 = Household size (number of persons)

X_9 = Quality of planting materials (Dummy variable, 1 for good quality, 0 for poor quality).

X_{10} = Extension contact (Number of visits per annum)

X_{11} = Land tenancy (Dummy variable, 1 for land owner, 0 for tenant)

e = error term.

It is expected a *priori* that the coefficients of $X_1, X_3, X_4, X_6, X_7, X_9, X_{10}, X_{11} > 0$;

$X_2, X_5, X_8, < 0$.

Four functional forms of the model; linear, semi-log, double-log, and exponential were tried to determine the lead equation based on having the highest value of coefficient of multiple determination (R^2), highest number of significant variables, and conformity to a *priori* expectations.

RESULTS AND DISCUSSION

Farmland suitability

The distribution of cassava farmers according to suitability of farmland cultivated is presented in Table 1. Contents of the table show that farmland suitability index ranges from 0.107 to 0.912 with a mean of 0.353. Majority (62.5%) of the cassava farmers cultivate on non-suitable farmland, 33.6% of them cultivate on marginally suitable farmlands, while few (3.9%) of them cultivate on suitable farmlands, implying that majority of the farmlands cultivated for cassava production in the study area are not suitable.

Table1. Distribution of Cassava farmers according to farmland suitability.

Suitability Index	**Frequency**	**Percentage.**
0.107 -3.00*	145	40.3
0.301 - 0.494*	80	22.2
0.495 - 0.688**	121	33.6
0.689 - 0.882***	8	2.2
0.883 and above***	6	1.7
Total	360	100
Mean	0.353	

* Non- suitable farmland

** Marginally suitable farmland

*** Suitable farmland

Source: Field survey Data, 2013

Farmland productivity

The productivity of different farmland value systems were determined and the results were presented in **Table 2,** which indicates that the Productivity of farmland increases from 1.38 to 2.00 and 3.16 as farmland moves from non-suitable to marginally suitable and suitable value systems respectively, thus making marginally suitable and suitable farmlands about 52.2%

and 129% higher in farmland productivity than non- suitable farmlands, implying that farmland productivity increases with suitability of farmland.

Table 2 Productivity of different farmland value systems

Variable	Non-suitable Farmland	Marginally Suitable Farmland	Suitable Farmland
Total Returns of Cassava and Cassava Products	61785.47	103690.36	182309.55
Total Rent and Cost of Farmland Improvement	44772.08	51845.18	57692.89
Productivity	1.38	2.00	3.16
Percentage Change	__	52.17	128.99

Some: Field survey Data, 2013

Factors affecting productivity of different farmland value systems

To determine the factors affecting productivity of different farmland value system; four functional forms of the Ordinary Least. Squares Multiple Regression model; linear, semi-log double –log, and exponential were tried. The double –log function produced the highest value of coefficient of multiple determination (R^2), highest number of significant variables, and conformed to a *priori* expectations. The results of the double log function are presented in table 3. Results show that the coefficients of multiple determination (R^2) were 0.592, 0.683 and 0.527 for non-suitable farmland, marginally suitable farmland and suitable farmland respectively, which implies that about 59.2%, 68. 3% and 53% of the variations in farmland productivity in non suitable, marginally suitable and suitable farmlands respectively can be explained by the included explanatory variables.

The coefficients of rent on land (X_2) quantity of fertilizer applied (X_3) household size (X_8), quality of planting materials (X_9) and land tenancy (X_{11}) with respect to the non- suitable farmlands were significant at either 0.05 or 0.01 levels. This implies that these variables affect productivity of non-suitable farmlands in the study area. For marginally suitable farmlands, the coefficients of farm size (X_1), rent on land (X_2), Quantity of fertilizer applied (X_3), Level of education (X_6), quality of planting materials (X_9), extension contact (X_{10}), and land tenancy (X_{11}) were significant at either 0.05 or 0.01 levels, which implies that these variables are important factors affecting productivity of marginally suitable farmlands in the study area.

The coefficients of farm size (X_1), quantity of fertilizer applied (X_3), farming experience (X_7), household size (X_8), quality of planting materials (X_9), and land tenancy (X_{11}) with respect to suitable farmlands were significant at 0.05 level of probability, implying that these variables are important factors affecting the productivity of suitable farmlands in the study area.

Table 3. Results of Double-log Function on Factors Affecting Productivity of Different Farmland Value Systems

Explanatory Variable	**Farmland Value Systems**		
	Non-suitable farmland	**Marginally Suitable Farmland**	**Suitable land**
Constant	116.039	131.557	148.602
Farm size (x_1)	0.047	0.063	0.051
	(1.802)	(3.602)**	(4.312)*
Rent or land (x_2)	-0.038	-0.041	-0.037
	(-2.472)*	(-2.711)**	(-1.912)
Quantity of fertilizer applied (x_3)	0.071	0.066	0.058
	(3.016)**	(3.083)**	(4.627)*
Quantity of agro-chemicals applied (x_4)	0.066	0.083	0.074
	(1.817)	(1.772)	(1.669)
Distance to farmer's home (x_5)	-0.084	-0.079	-0.085
	(-1.509)	(-1.813)	(-1.392)
Level of education (x_6)	0.033	0.052	0.049
	(1.714)	(3.239)**	(1.873)
Farming experience (x_7)	0.069	0.047	0.055
	(1.903)	(1.825)	(4.529)*
Household size (x_8)	-0.087	-0.083	-0.072
	(-2.518)*	(-1.662)	(-4.819)*
Quality of planting materials (x_9)	0.092	0.087	0.067

	(2.573)*	(3.108)**	(4.419)*
Extension contact (x_{10})	0.071	0.069	0.088
	(1.529)	(2.538)*	(1.703)
Land tenancy (x_{11})	0.056	0.064	0.072
	(3.118)**	(2.815)**	(4.683)*
R^2	0.592	0.683	0.527
No. of observations	225	121	14

Figures in parentheses are t-ratios

*and ** mean significant at 0.05 and 0.01 levels

Source: Summarized from computer output, 2013

CONCLUSION AND RECOMMENDATION

The study found that majority of the farmlands cultivated in Imo state, Nigeria are non-suitable for cassava production due to the influence of ecological factors, and this negatively affects cassava productivity.

Farmers cultivating non-suitable farmlands should minimize wastage of production resources through a reduction in the size of farmland cultivated, while farmers cultivating suitable farmlands should increase their cassava output and improve their farm income through allocation of more production resources to cassava production in an optimal manner.

REFERENCES

Bassey, E.E .2008. The Effect of Land Tenure on Natural Resources Conservation in Nigeria Rainforest Ecosystem. www.environsecurity.org/espa/PDF/ESA-DRC

Beek, K.J. 1978. Land Evaluation for Agricultural Development. Netherlands. In proceedings of the First National Seminar on Agricultural Land Resources, Kaduna, Federal Department of Agriculture Land Resources. Pp.225.

Dixon, P.B and McDonald, D. 1990. *Measurement of productivity, Economic Record* (68): 105-117.

Eswaran, H. Lal. R and Reich. P.F. 2001. Land Degradation; An Overview United State Department of Agriculture, Natural Resource Conservation Service. Oxford press.

Korie, O.C, Ohajianya, D.O and Ehirim, N.C. 2006.. *Value chain of Cassava and cassava based-products in Imo State, Nigeria. International Journal of Natural and Applied Sciences* 2(4):400-404

Oyekale S.A. 2008. Suitability of land. Journal of Sustainable Development Department of Agricultural Economics, University of Ibadan.

Okere, R.A. 2012. Analysis of Land Value Systems and Productivity of Cassava in Imo State. M.Sc Thesis, Department of Agricultural Economics, Federal University of Technology Owerri.

Verheye W. H. 1999. Land Use, Land Cover and Soil Science; An Encyclopedia of Life Support System, Vol.1 Pp.19-26

Verheye, W; Brinkman, R.; Sims, D. 1997. Elements of a Different Approach to Land Development Issues. *The Land Resources Issues.* Vol. 1, No.2, Pp.143-52