Analysis of Small Scale Cassava Farmers Productivity for Sustainable Agriculture in Oyo State Nigeria

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Abstract: **- Using a cross sectional data for the analyses of the determinants of cassava productivity on small holder cassava farmers in Oyo State, Nigeria. Descriptive statistics was used to analyze the farmer's farm specific and socio economic characteristics and inferential statistics was employed to analyse the determinant of crop production using 176 respondents. The result revealed that 73.9% of the farmers were male, 80.7% were married, farmers mean age was 50 years, mean household size was six (6) persons, 87.5% had farm size between 0.5-5.0 hectares, majority (89.2%) had one form of formal education while 82.4% relied on rain-fed farming system, cassava output was 37.50 tons and mean farm size used was 2.89 hectare while mean years of faming experience was 13.4 years. Estimated parameters with Cobb Douglas production functions show that farm size used, years of farming experience, farmers' age, source of irrigation and income increased productivity at 1% respectively except farm management experience which reduced productivity at 10% level of significant. R^2 was 74% which explain the level of variation in the crop outputs as a result of the explanatory variables. It was however concluded that farm size, farmers' age, years of farming experience, source of irrigation and farmers income were the major determinants of farm productivity in the study area. The study therefore recommended among others that informal training through extension services be conducted to educate farmers in other to have a sustainable and increase productivity and provision of another source of irrigation (mechanise) instead of depending on rain fed agriculture in the study area.**

Keywords**: Determinant, Sustainable, Land, Cobb Douglas, Fuzzy, Oyo State, Nigeria.**

I. INTRODUCTION

Agricultural sector has always been an important component of Nigerian economy. The sector is almost entirely dominated by small scale resource poor farmers living in the rural areas, with farm holdings of 1-2 hectares, which are usually scattered over a wide area. (Ojo *et al*., 2009). The size-distribution of these holdings as defined by previous studies and evidenced in literature by (Olayide *et al*., 1980 and Dorward *et al*., 2005) as; Small-scale farms, ranges from 0.10 to 5.99-hectares, medium scale, 6.0-9.99 and large scale above 10 hectares. These classes constituted 84.49 percent, 11.28 percent and 4.23 percent respectively in 2004 (NBS, 2006). According to Olayide *et al*., (1981), about 75% of Nigeria's land is under arable cultivation with land-human ratio of 58 persons per square kilometer in south western Nigeria. Sustainable agriculture has been defined variously by different authors (Idachaba, 1987; Young, 1989; Keaney, 1989; Okigbo, 1991; Spencer and Swift, 1992). However FAO (1989) defined sustainable agriculture as one, which involves the successful management of resources for agriculture to satisfy human needs, while maintaining or enhancing the quality of the environment and conserving natural resources. Sustainable land management (SLM) is defined as a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food and fiber demands while sustaining ecosystem services and livelihoods. Sustainable land management (SLM) has been defined as the adoption of appropriate land management practices that enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources (FAO, 2009).

Traditionally through time, farmers have developed different soil conservation and land management practices of their own. With these practices, farmers have been able to sustain their production for centuries thus the determined effects of resource exploitation has become widespread, there has been growing awareness that productive lands are getting scarce, land resources are not unlimited, and that the land already in use needs more care. As a result of the increase in world population, other non-agricultural activities are demanding for land space, hence there is progressive loss of land for food production. At the same time, demand for food and other agricultural products is increasing, requiring for more land which is not available since the earth's land area is finite (Ogunkunle, 2004).

The extent of land degradation in Nigeria is presently alarming. This occurs in different scales and dimensions and no part of the country can be entirely excluded. Also, compared with some other African countries, the country is blessed with abundant land resources, which are capable of indefinite regeneration over a given period of time f the prevailing management practices are conducive. Management issue cannot be taken for granted, given that these resources constitute the productive base for the Nigerian agriculture,

upon which the livelihoods of many rural and urban household depend Oyekale, (2012), moreover, poor incentives for natural resource conservation, among other socio economic problems, have subjected the soils nutrients to serious exploitation and thereby affecting crop outputs potentials. Hence this raises the research objectives as to:

i. examine the farm-specific and socio economic characteristic of the farmer in the study area
ii. analyse the determinant of Crop productivity in the study area

II. METHODOLOGY

2.1. The study area

This study was carried out in Oyo State, Nigeria, the State is located in the Southwestern part of the country, Oyo State consist of thirty three (33) local government areas grouped under four (4) agricultural zones of Oyo State Agricultural Development Programme (OYSADEP).—The zones are: Ibadan-Ibarapa, Oyo, Saki and Ogbomoso Zones. Oyo State covers a total land area of about 27,249,000 square kilometers with a total population of about 5.6million (National Population Commission, 2006). It is situated between Latitude 7^o N and 19^oN and Longitude 2.5^oE and 5^oE of the meridian. The state is predominantly agrarian, annual mean rainfall is above 1000 mm and the rainy season in the state average eight months in a year. Rain starts in Oyo state during the first week of March with storms. Mean temperature varies from daily minimum of 18.9^0C to a daily maximum of 35^0C. Humidity is quite high in Oyo state; relative humidity in the state is 70 percent with a maximum of about 60 percent in the evening and a maximum of around 80 percent in the morning.

The settlement pattern indicates that so many people of various Nigerian ethnic backgrounds reside in Oyo state. However, Nigerians with Yoruba ethnic background constitute the majority of the population living in the state. The primary occupation of the people is farming and farms are subsistence and semi-commercial units which depend mostly on rainfall as the chief source of water supply; that is the farmers in Oyo state cultivate land at the expense of rain. The prevailing vegetation type of Oyo state is that of Guinea Savanna woodland which is characterized by species of *Derived Savanna* especially the Oyo and Saki zones while Ibadan – Ibarapa zone is a Tropical rain forest.

2.2. Sampling technique and sampling size

Multi-stage method and purposive random sampling technique was used to obtain data for this study through the use of structured questionnaires.

The first stage was the choice of choosing the existing four Agricultural zones, namely, Ibadan-Ibarapa, Oyo, Saki and Ogbomoso zones, Second stage involved purposive selection of the respondents under each zone where these farmers are concentrated. The list of the farmers in these areas was sought from Oyo State agricultural development programme (OYSADEP) and Federal Department of Agriculture (FDA). Third stage: Ten percent (205) of the respondent were selected according to the population of the registered cassava farmers from the list of the Nigeria Cassava Growers Association (NCGA) across the four agricultural zones in Oyo State. Lastly, random selection of the respondents from each of the zones which comprises of 60(50), 55(46), 40(40) and 50(40) from Oyo, Ogbomoso, Ibadan / Ibarapa and Shaki zones respectively according to the population of registered farmers in each of the zones in the State, a total of 176 questionnaires (figures in parenthesis) were retrieved and used for this study. The study used data obtain mainly from primary source.

2.3. Analytical techniques

Descriptive statistics was used to analyze the farm-specific and socio-economic characteristics of the farmers while the multiple linear regression model was used to analyse the determinant of the Crop output in the study area. A derivative of production function analysis was adopted to estimate the effects of land management practices on the level of Crop yields. One way to measure the effects of such land management options is to include these management practices in the production function as variables, separate from physical inputs (Ali, 1996) and (Asuming-Brempong, 2010)

A general form production function (in matrix form) can be specified as:

$Y = f(X)\, e^u$ ----- (1)

Where Y is the output of the particular crop, X is a vector of variable inputs, e is the error term, and u is the exponential term. The first derivative of equation (1) with respect to the various production variables effects on crop yields. In this analysis, a multiple regression model was estimated to provide quantitative measures of the effects of these inputs on crop yields using STATA statistical analysis software.

The model used for the estimation was given as:

Model specification

$$Y = b_0 + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5 \ldots\ldots\ldots\ldots X_{11} + \mu \quad (2)$$

$Yi = f(Xij, \alpha j)$ … **(**implicit form)

$Y = f(Xs)$

$Y = (X_1, X_2, X_3, \ldots X_n)$

Linear

$$Y = (a+b_1X_1+b_2X_2+b3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+b_{10}X_{10}+ b_{11}X_{11}+ b_{11}X_{11} +e)$$

Double log

$$LnY = (a+ b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_6\ln X_6 \ldots\ldots\ldots\ldots b_{11}\ln X_{11} +e)$$

Semi-log

$Y = (a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 \ldots\ldots\ldots\ldots b_{11} \ln X_{11} + e)$

Exponential

$\ln Y = (a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 \ldots\ldots\ldots\ldots b_{11}X_{11} + e)$

Where,

Where Y = the crop output (kg)

X_1 = Farming experience (years)

X_2 = Farm size (ha)

X_3 = Educational level (dummy)

X_4 = source of credit (dummy)

X_5= Types of Land ownerships (dummy)

X_6 = land use duration (years)

X_7 = Age of respondent (years)

X_8 = farm income (Naira)

X_9 = farm management experience (years)

X_{10} = mode of cultivation (dummy: local/manual = 0, mechanized = 1)

X_{11} = source of water (dummy)

e = error term

b = Parameter to be estimated

a = Constant

III. RESULTS AND DISCUSSION

Farm-specific and Socio-economic characteristics of the respondents

The table 1 shows that 29.6% of the farmers are between the ages of 51-60 with the mean age of 50.2 years; this shows that farming population is already ageing. Most of the respondents falls between the mean age and are actively involved in farming practices. Male farmers contribute 73.9% of the population sampled while 80.7% were married, majority of them (33%) attained secondary school education meaning that an average farmers in the area did not go beyond secondary education, (Oluwemimo, 2010). About 60.2% had between 6-10 family household size with mean value of 6.3, an indication of availability of family labour to the farmers, 84.7% were mainly crop farmers, 51.1% source their credit through cooperative society because they belong to an association, 63% and 61% purchase and inherited their farm land respectively while 50% had between 1-10 years of farming practices experience, this could enhance the farmers to embark on a proper management of their farm land in order to sustain productivity, 90.3% used hired labour, 82.4% depends on rainfall as the source of water to the farm also 85.8% still practice local/manual mode of cultivation which they are used to. 87.5% used between 0.5-5 hectares of land for their farming activities, 43.2% and 42.6% used the same hectares of land between 1-10 years and 11-20 years respectively. This implies that continuous farming on the same plot of land may cause soil nutrient lost and reduce crop yield, 43.8% and 40.3% had between 1-10 years and 11-20 years of farm management experience. This may influence land management, soil conservation and increase crop yield, 72.2% had between =N= 101,000 - =N= 500,000 levels of income while average/mean income per capital was =N= 391,079.00k with their level of output which was 37.5 tons per 2.89 hectares of their farm size used.

3.1. Determinant of the Crop output in the study area

From table 3, different functional model were fixed for the determinant of crop output among the farmers, four functional forms (linear, semi log, exponential and double log) were used, but the double log was chosen. The choice of the line as function is predicated on its confirmation to apriori expectation in terms of signs and magnitude of the coefficient, the number of significant variables and the coefficient of multiple determinations (Olayemi and Olayide, 1981) and the significance of the overall profitability as judge by the t-value.. The results revealed that farm size used, years of farming experience, Age of farmer and income were positively significant at 1% level except for farm management experience which has a negative coefficient to the level of crop outputs, but also significant at 1%. Source of water was also positively significant at 10% level. These implies that an increase in any of these variables will bring a proportionate increase in the level of crop outputs (Babalola *et al*., 2013; Oyewo *et al*., 2014) except for farm management experience which could bring about a reduction in the level of output due to the low level of years of farm land management practices experience and low level of education by the farmers which conform with the work of Oyekale, (2012). R^2 was 0.740 which shows that 74% of the variability in the level of outputs is associated with the explanatory variables specified in the model, while 26% could explain the variables that were not captured in the model.

IV. CONCLUSION

The study undertakes the determinants determinant of sustainable land management practices among small holder cassava farmers in Oyo State which comprises of Four Agricultural zones. A multistage sampling technique was employed in selecting 176 Cassava farmers. Primary data was collected through a well structured questionnaire which were coded and analysed with the use of descriptive, inferential statistics, multiple regression and fuzzy logic analyses.

Multiple regression analysis was employed to determine the farm specific and socio economic factors that influence crop outputs among 176 crop farmers. Estimated parameters with multiple regression show that farm size used, years of farming experience, age of farmers, income were positively significant

at 1% except farm management experience which was negatively signed but significant at 10% level to the crop outputs. R^2 was 74% which explain the level of variation in the crop outputs as a result of the explanatory variables. It was discovered that farming experience, farm size, age of respondents and source of water contribute to the increase in the crop output except farm management experience which decreases output in the study area.

V. RECOMMENDATIONS

Based on the result and findings of the study the following are therefore recommended.

- Informal training through extension officers can be conducted to educate the farmers on sustainable land use practices that can deplete soil through extension officers.
- The government agencies saddled with the responsibility of disseminating information to farmers through extension service departments should step up her efforts in creating awareness through mass orientation on the need for farmers to involve themselves in sustainable agricultural practices in order to have a better environment which will improve productivity in the study area.
- Government should direct Agricultural banks to focus on small scale farmers in other to have access to micro credit which can result in environmental conservation.
- Changes in land quality should be monitored to provide early warning of adverse trends and identify problem areas.
- For policy purpose, government should further encourage her credit support programme to enhance better land management practices.
- Better researches results of improved agronomic practices should be extended to the farmers by the extension agents.

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Appendix

Table 1: Farm-specific and Socio economic characteristics of the farmer

Variable	(N= 176)	frequency	percentage (%)	mean
Age				
21-30		17	9.7	
31-40		31	17.6	
41-50		46	26.1	
51-60		52	29.6	
61 and above		30	17.0	50.15
Gender				
Male		130	73.9	
Female		46	26.1	
Marital Status				
Single		12	6.8	
Married		142	80.7	
Divorced		8	4.5	
Widow		7	4.0	
Widower		7	4.0	
Educational Level				
No formal Education		19	10.8	
Primary education		47	26.7	
Secondary education		58	33.0	
Tertiary education		52	29.5	
Household Size				
1-5		63	35.8	
6-10		106	60.2	
11-15		7	40	6.30
Primary occupation				
Livestock		19	10.8	
Crop		149	84.7	
Hunting		8	4.5	
Source of Credit				
Friend		4	2.3	
Family		7	4.0	
Government		4	2.3	
Loan		40	22.7	
Cooperative		90	51.1	
Personal Saving		31	17.6	
Source of land				
Inheritance		61	34.7	
Purchase		63	35.8	
Rent / Lease		47	26.7	
Community		3	1.7	
Government		2	1.1	
Source of labour				
Family		17	9.7	
Hired		159	90.3	
Farming experience				
1-10		88	50	
11-20		67	38.1	
21-30		16	9.1	
31and above		5	2.8	13.4
Source of water				
Irrigation		31	17.6	
Rainfall		145	82.4	

Mode of cultivation			
Local / manually	151	85.8	
Improved mechanical tech	25	14.2	

Table 2: Farm-specific and Socio economic characteristics of the farmer continued

Variable (N= 176)	**frequency**	**percentage (%)**	**mean**
Farm size used (hectare)			
0.5-5.0	154	87.5	
5.1-10	20	11.4	
10.1-15	2	1.1	2.89
Land use duration (year)			
1-10	76	43.2	
11-20	75	42.6	
21-30	19	10.8	
31 and above	6	3.4	13.9
Farm management experience (year)			
1-10	77	43.8	
11-20	71	40.3	
21-30	22	12.5	
31-40	6	3.4	14.2
Level of income (Naira)			
10000-100000	7	4.0	
101000-500000	127	72.2	
501000-1000000	40	22.7	
1000001 and above	2	1.1	391079.6
Output (tons)			
10-20	48	27.3	
21-30	47	26.7	
31-40	13	7.4	
41-50	26	14.8	
51-60	21	11.9	
61 and above	21	11.9	37.50

Source: field Survey, 2016

Table 3: Determinant of the Crop output in the study area

Variable	**Linear**	**Double log**	**Exponential**	**Semi-log**
a = Constant	7.106	-0.054	1.084	-76.377
X_1 = Farming experience	0.428***	0.172***	0.005***	13.911***
	(3.114)	(3.800)	(3.128)	(3.197)
X_2 = Farm size	4.293***	0.0572***	0.045***	48.150***
	(4.764)	(8.875)	(4.266)	(7.768)
X_3 = Educational level	-1.148	-0.058	-0.015	-2.499
	(-0.856)	(-0.933)	(-0.936)	(-0.419)
X_4 = source of credit	-0.647	-0.005	-0.002	-2.541
	(-0.629)	(-0.075)	(-0.196)	(-0.421)
X_5= Types of Land ownerships	1.275	0.088	0.011	11.594*
	(1.027)	(1.289)	(0.742)	(1.766)
X_6 = land use duration	0.046	-0.063	-0.002	-5.060
	(0.227)	(-1-155)	(0.011)	(-0.961)
X_7 = Age of respondent	0.144	0.240***	0.003**	10.155
	(1.474)	(2.013)	(2.321)	(0.883)

X_8 = farm income	0.003***	0.187***	-0.000***	15.584**
	(1.474)	(2.647)	(3.760)	(2.292)
X_9 = farm mgt experience	-0.605***	-0.204***	-0.007***	-16.757***
	(-3.014)	(-3.682)	(-2.785)	(-3.146)
X_{10} = mode of cultivation	3.772	0.036	0.054*	2.489
	(1.474)	(1.460)	(1.815)	(-0.872)
X_{11} = source of water	4.758*	0.048*	0.040	5-216**
	(1.661)	(1.746)	(1.179)	(1.059)
R^2	0.622	0.740	0.611	0.678
F Statistics	22.316	38.570	21.336	28.613

Source: author regression 2016. (*) = 10%; (**) = 5%; (***) = 1% significant.
Note: Values in parenthesis are t-values