Sustainable Agricultural Practices and Its Determinants in South-East Nigeria

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***Abstract*—This study evaluated sustainable agricultural practices and its determinants in South-East Nigeria. Data were collected with structured questionnaire from 180 randomly selected cassava-based farmers. Data bothering on the farmers' socioeconomic characteristics, the type, quantity, price and sources of inputs used and output produced were collected. These were analyzed with the use of descriptive statistical tools, sustainable agriculture practice index and multiple regression techniques. Results showed that farmers mean age, level of education, farming experience, farm size, and extension contact were 50.6 years, 9.4 years, 19.8 years, 0.83 hectare, and 0.78 visit respectively. The mean sustainable agriculture practice level of farmers was 0.43 indicating unsustainable agriculture practices among the farmers. There is need to improve on the sustainable agriculture practice level of farmers in South-East Nigeria through extension education so as to achieve food security and conserve the resource base.**

***Index Terms*—sustainable, agriculture, determinants, south-east**

I. Introduction

Agriculture is the main source of food in Nigeria, and employs about 60-70 percent of the population [1]. The dominant crops in the South are cassava, yam, maize, cocoyam, vegetables, palm produce, cocoa and rubber while cereals (notably millet and sorghum) groundnuts and beans dominate crop production in the Northern part of Nigeria. According to the Nigerian National Bureau of Statistics [NBS], agriculture in 2008 contributed 42.2% to Gross Domestic Product [GDP], followed by oil and Gas [19.35%], manufacturing (4.025%) and solid minerals (0.29%) [2]. These analogies suggest that agriculture occupies a very prominent position in the growth and development of Nigerian economy.

The Nigerian population was estimated at 170 million people, with population density of 583 persons per sq. km [3] indicating that there is pressure on the resource base. However, the pressures of an increasing population are understood to cause increasing food demands by urban consumers and rural farmers, the expansion of areas of activation, reduced fallow intervals with a lack of inputs necessary to compensate, and as a result reduced soil fertility [4]-[6].

Yet the capacity of available resources and technologies to satisfy the demands of this growing population for food and other agricultural commodities remains uncertain. Agriculture has to meet this challenge by increasing production on land already in use in a sustainable way and enhance food security. Sustainable agriculture refers to the ability of a farm to produce perpetually base on long-term effects of various practices on soil properties and processes essential for crop productivity, and the long-term availability of inputs [7], [8]. According to [9], sustainable agriculture involves production activities that minimizes the use of external inputs and maximizes the use of internal inputs, which already exists on the farm.

Given the current international debt issues and food security problems, it has become increasingly difficult to generate enough local resources required for sustainable agriculture without exerting increased pressure on internal inputs.

It is imperative therefore to determine sustainable agriculture practice level of the farmers and ascertain the determinants of sustainable agriculture practice level in South-East Nigeria so as to suggest policies and measures that will enhance sustainable agriculture practice in Nigeria.

II. Materials and Methods

The study was conducted in Imo and Ebonyi States of South-East Nigeria. The study used multi-stage sampling technique in sample selection. The topographic peculiarity of the South-East states enabled the clear division of the states into two distinct categories of relatively hilly terrain states (Enugu, Ebonyi and Anambra) and the relatively flat terrain states (Imo and Abia). One state was purposively selected from each category and this gave rise to Imo and Ebonyi states as the two states of interest in this study. Secondly, two agricultural zones were randomly selected from each of

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the states to get a total of four agricultural zones. Thirdly, three Local Government Areas (LGAs) were randomly selected from each agricultural zone to get 12 LGAs. In the fourth stage, two communities were purposively selected from each LGA to get a total of 24 communities. Lastly, one village was randomly selected from each community to get a total of 24 villages used for the study. From this sampling frame of 217 cassava-based farmers from Imo State and 148 cassava-based farmers from Ebonyi State, proportionate and random sampling techniques were used to select a sample size of 180 cassava-based farmers composed of 102 from Imo State and 78 from Ebonyi state.

Primary data were mainly used for this study and were collected from cassava-based farmers with the aid of structured. Data were collected on variables such as socioeconomic characteristics of farmers, quantities and types of inputs used, outputs produced in physical and value terms, climate variables, cost of labour, cost of fertilizer and type of labour used. Data were analyzed using descriptive statistical tools, sustainable agriculture practice index, and multiple regression techniques.

The socioeconomic characteristics of farmers were analyzed using mean, frequencies and percentages, while sustainable agriculture level of farmers was analyzed using sustainable agriculture practice index. The determinants of sustainable agriculture practice were ascertained with the use of multiple regression techniques. Its model was implicitly specified as:

$$S_A = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, e) \quad (1)$$

where S_A = Sustainable Agriculture practice, which according to [9], is given by:

$$S_{A = Nsin/} T_{Nin} \text{ X } 100_{/1} \quad (2)$$

S_A = Sustainable Agriculture practice Index
S_{Sin} = Number of sustainable inputs used by a farmer per production cycle
T_{Nin} = Total number of inputs used by a farmer per production cycle
X_1 = Extension contact (Number of times visited by extension agents per production cycle)
X_2 = Age of farmer (years)
X_3= Level of education (Number of years spent in school)
X_4 = Farm size (Hectare)
X_5 = Household size (Number of persons)
X_6 = Annual income (Naira)
X_7 = Cost of labour (Naira)
X_8 = Cost of fertilizer (Naira)
X_9 = Amount of family labour used (Man-days)
X_{10} = Climate change variables (Dummy variable, 1 if farmer perceived changes in climate variables, 0 if otherwise)
X_{11} = Availability of organic manure (Dummy variable, 1 if readily available, 0 if otherwise)
X_{12} = Availability of irrigation facility (Dummy variable, 1 if available, 0 if otherwise)
X_{13} = Access to credit (Dummy variable, 1 for access, 0 if otherwise)
X_{14} = Social organization membership (Dummy variable, 1 if member, 0 if otherwise)
e = error term

It is expected *apriori* that the coefficients of X_1, X_2, X_3, X_4, X_5, X_6, X_9, X_{11}, X_{14} >0; X_7, X_8, X_{10}, X_{12}, X_{13}, <0

III. Results and Discussion

A. Socioeconomic Characteristics of the Farmers

Contents of Table I indicate that the mean age of cassava farmers was 50.6 years, which implies that the farmers are within the productive age limit to engage in all forms of productive labour especially farm labour. The mean household size of farmers in the study area was 8 persons, mean annual farm income was ₦306412.75 and mean farm size was 0.83 hectare. This implies that the farmers in the study area are small holder and resource poor farmers [10], [11].

TABLE I. Shows the Summary of Socioeconomic Characteristic of Farmers

Socioeconomic characteristics	Mean	Standard deviation	Range
Age (years)	50.6	11.2	29-73
Household size (persons)	8	3.7	3-14
Annual farm income (₦)	306412.75	103.64	103700-8439516
Level of education (years)	9.4	3.8	0-19
Farming experience (years)	19.8	7.6	3-47
Farm size (Hectares)	0.83	0.39	0.27-3.4
Extension contact (No. of visits)	0.78	0.13	0-4

Source: Field Data, 2014

The mean annual income of farmers implies that they leave below $1.25 US Dollars per day, indicating high poverty level among the farmers. Mean extension contact was 0.83 times. This implies that extension education in the study area was very poor, and as such farmers will be lacking a lot in terms of availability and use of agricultural innovations. The mean level of education of farmers was 9.4 years, which implies that farmers are enlightened enough to be able to adopt available agricultural innovations when introduced to them in the study area.

B. Sustainable Agriculture Practice Level of Farmers

The distribution of farmers according to sustainable agriculture practice level is presented in Table II.

TABLE II. Distribution of Farmers According to Sustainable Agriculture Practice Level

Sustainable agriculture practice level	Frequency	Percentage
0.27-0.37	83	46.1
0.38-0.48	45	25.0
0.49-0.59	33	18.3
0.60-0.70	13	7.2
0.71-0.81	6	7.2
Total	180	3.4
Mean	0.43	100

Source: Field Data, 2014

Data in the table show that many (46.1%) of the farmers had sustainable agriculture practice level of 0.27-0.37, followed by 25% of them that had sustainable agriculture practice level of 0.38-0.48. Only 3.4% of the farmers had sustainable agriculture practice level of 0.71-0.81. Mean sustainable agriculture practice level of the farmers was 0.43, indicating unsustainable agriculture practice and implies that most of the farmers in the study are used more of external inputs in their production system.

C. Determinants of Sustainable Agriculture Practice

Table III presents the multiple regression results showing the determinants of sustainable agriculture practice level in South-East Nigeria. This was achieved by estimating equation 1 using four functional forms of linear, semi-log, double-log and exponential. Table III shows that, out of the four functional forms fitted, double-log function best explained the regression relationship between the endogenous variable, and the exogenous variables with an R^2 value of 0.794. This implies that about 79% of the variations in sustainable agriculture practice level of farmers production systems were caused by variations in the independent variables included in the multiple regression models. The coefficient of multiple determinations (R^2) was statistically significant at 1% level with an F-value of 43.626. It is obvious from Table III that out of the 14 explanatory variables suspected to affect sustainable agriculture practice level of farmers, 12 (i.e. Age, level of education, farm size, household size, annual income, cost of labour, cost of fertilizer, amount of family labour used, climate change variables, availability of organic manure, access to credit, and social organization membership) were found to be statistically significant at 5% and 1% levels, whereas the other two (extension contact and availability of irrigation facility) were not significant at 5% level. This implies that changes in the significant variables seriously affected sustainable agriculture practice level of farmers in the study area.

Therefore, the determinants of sustainable agriculture practice level of farmers were age, level of education, farm size, household size, annual income, cost of labour, cost of fertilizer, amount of family labour used, climate change variables, availability of organic manure, access to credit, and social organization membership.

Table III further shows that variables such as level of education, farm size, annual income, climate change variables, and access to credit were inversely proportional to sustainable agriculture practice level of farmers. This implies that the higher the values of these variables, the lower the sustainable agriculture practice level of farmers sand vice versa. For instance, the higher the annual income, the higher the access to credit and the larger the farm size, the higher the tendency of farmers to use hired labour instead of family labour, fertilizer instead of organic manure, herbicide instead of only manual weeding, tractor instead of hoes and shovel, etc. This finding agrees with that of [12] and [13] who found that higher income and access to credit position the farmers to be able to procure those external inputs like herbicide, fertilizers, tractors, irrigation facility, etc. Also, the more the climate changes the lesser the sustainable agriculture practice level of farmers. This makes the farmers to adopt coping strategies that are not easily affordable to them.

TABLE III. MULTIPLE REGRESSION RESULTS SHOWING THE DETERMINANTS OF SUSTAINABLE AGRICULTURE PRACTICE LEVEL OF CASSAVA-BASED FARMERS IN SOUTH-EAST NIGERIA

Explanatory variable & Important statistics	Linear function	Semi-log Function	Double-log Function	Exponential Function
Constant	216.413	173.016	137.442	102.527
Extension contact (X_1)	-11.068 (-1.802)	-3.115 (-1.622)	-0.081 (-1.913)	-0.006 (-1.387)
Age of farmer (X_2)	13.923 (2.541)*	4.187 (1.834)	0.085 (2.552)*	0.009 (2.487)*
Level of education (X_3)	-12.113 (-2.461)*	-3.403 (-2.922)**	-0.088 (-3.196)**	-0.005 (-3.068)**
Farm size (X_4)	-10.826 (-1.729)	-2.702 (-1.346)	-0.053 (-3.539)**	-0.008 (-3.101)**
Household size (X_5)	12.912 (1.443)	3.817 (1.306)	0.064 (2.541)*	0.005 (2.493)*
Annual income (X_6)	-14.544 (-3.016)**	-3.093 (-1.948)	-0.073 (-3.008)**	-0.007 (-2.552)*
Cost of labour (X_7)	11.082 (2.893)**	4.752 (2.746)**	0.088 (3.106)**	0.009 (3.007)**
Cost of fertilizer (X_8)	13.094 (1.913)	3.527 (1.887)	0.073 (2.545)*	0.006 (1.933)
Climate change variables (X_9)	-10.877 (-1.746)	-3.093 (-1.914)	-0.066 (-2.538)*	-0.005 (-2.497)*
Availability of organic manure (X_{11})	11.083 (2.541)*	2.187 (1.653)	0.089 (3.607)**	0.007 (3.112)**
Availability of irrigation facility (X_{12})	10.683 (1.776)	3.092 (1.803)	0.082 (1.637)	0.003 (1.916)
Access to credit (X_{13})	-11.397 (-2.483)*	-3.713 (-1.692)	-0.099 (-3.803)**	-0.006 (-2.915)**
Social organization membership (X_{14})	10.337 (1.703)	2.915 (1.827)	0.068 (2.993)**	0.007 (1.829)
R^2	0.516	0.483	0.794	0.683
F-Value	12.709**	11.129**	43.626**	25.677**
Sample size (n)	180	180	180	180

Figures in parentheses are t - ratios
*Significant at 5%
**Significant at 1%
Source: Summarized from computer output, 2014

Results also show that variables like age, household size, cost of labour, cost of fertilizer, amount of family labour used, availability of organic manure, and social organization membership were found to be directly proportional to sustainable agriculture practice level of farmers. This implies that the higher the values of these variables, the higher the sustainable agriculture practice level of farmers. It is obvious that the higher the age of farmers, the more conservative they become, and the more they depend on their family labour for food production. Also, the higher the labour cost, the more farmers depend on family labour and communal labour which are relatively free or cheap to use. Similarly, the

higher the cost of fertilizer, the lower the tendency of farmers to use them, hence they depend on organic manure or natural soil replenishment of nutrients.

Finally, the more the social organizations farmers belong to the higher their sustainable agriculture practice level. This is because memberships of social organizations enable the farmers to interact with one another and cross-fertilize ideas about sustainable farming practices. This finding supports those of [14].

IV. Conclusion

Cassava-based farmers in South-East Nigeria used less of the internal inputs and more of external inputs which resulted to low sustainable agriculture practice level. Determinants of sustainable agriculture practice level of cassava-based farmers in South-East Nigeria were age, level of education, farm size, household size, annual income, cost of labour, cost of fertilizer, amount of family labour used, climate change variables, availability of organic manure, access to credit, and social organization membership.

V. Recommendations

Consequent upon the findings of this study, there is need to improve on the sustainable agricultural practice level of farmers in South-East Nigeria through extension education so as to achieve food security and conserve the resource base. This should be intensified and geared towards making farmers to become more aware and understand the consequences of use of more external inputs on their resource base, and the inherent benefits associated with use of more internal inputs in food production.

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