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Sustainability of Farm Level Practices among Cassava Farmers in Kwara and Nasarawa States, Nigeria

D. B. Zaknayiba, . J. N. Nmadu, K.M. Baba and M.A. Ojo
Department of Agricultural Economics and Farm management, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State, Nigeria Makurdi, Benue State, Nigeria

E-mail of corresponding author: zaknayibadanladi@yahoo.com

A R T I C L E I NFO

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ABSTRACT

This study investigated the sustainability of farm level practices among cassava farmers in Kwara and Nasarawa States, Nigeria. Data were obtained directly from 256 respondents, selected through multistage random sampling technique, with the aid of structured questionnaire and interview schedules in six ADP zones of Kwara and Nasarawa States. The data were analyzed using descriptive statistics; farm level practices sustainability indicators and regression model. Results showed that majority of the respondents were male (94.1%) and married (97.7%) within the age bracket of 18 to 55years (79.6%) and up to 82.7% of them acquired some form of education. The results also indicated that mean household size was 10 and farm holdings was 2.9 hectares .Crop management was the most prevalent (59.2%) sustainable farm level practice while weed control was the least prevalent practice (1.6%) by cassava farmers in the study area. Regression analysis revealed that educational level (2.366), mean technical efficiency (2.617) and extension contact (3.886) had positive signs. This implies that a change in sign of mean technical efficiency, educational level and extension contact will led to increase in the level of sustainable farm practice among the cassava famers in the study area. Findings further revealed that shortage of extension services (100%) ranked first among the constraints faced by cassava famers in the study area. It is recommended that Government and Non-Governmental Organizations (NGO) to fund further research to boost cassava production, enhance sustainable practices and package more comprehensive extension services since extension contact was found to be totally absent in the study area.

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Introduction

Cassava is a very important crop to the economy of Nigeria. It is estimated that about 30 million farmers grow cassava with average yields of about 11 metric tons per hectare and annual output exceeding 33.8 million metric tons (Food and Agriculture Organization, FAO, 2002; International Institute of Tropical Agriculture, IITA, 2005). Estimate of output in 2011 was over 52 million metric tons (FAO, 2012). Apart from being a source of food to about 200 million people in the sub-Saharan Africa, cassava can contribute to employment creation, income generating capacity, and food security for many households in Nigeria (Ogunleye and Ojedokun, 2014).

Cassava food products are the most important staples of rural and urban households in northern Nigeria. Estimates showed that the dietary calorie equivalent of per capita consumption of cassava in the country amounted to about 238kcal (Cock, 1985). This is derived from the major cassava food forms of consumption such as gari, chip flour, fermented pastes and fresh roots. Cassava as a staple crop has become more popular in all locations and is fast overtaking the place of yam and other crops, increasing in gaining ground as an insurance crop against hunger. There is a strong demand for cheap food, especially cassava products within Nigeria (Ogunleye and Ojedokun, 2014).

The quest and the intervention by the government of Nigeria over the years to include cassava as one of the crops to boost the economy of the country have not yet yielded the expected results. No doubt, research has led to increases in the output of cassava over the last two decades, mainly as a result of increases in the area of land cultivated and improvements in the production efficiency through high-yielding, disease and pest-resistant cultivars (IITA, 2005). In spite of this, cassava

production is still characterized by high levels of variability and cyclical gluts, which are due mainly to the inability of markets to absorb supplies (IITA, 2005). Thus, output fluctuates from year to year to reflect the variation in the prices of the commodity.
For cassava to make significant contribution to agricultural development, sustainable strategies will have to be designed that will stretch beyond focusing largely on increasing farm productivity through the maximization of agronomic efficiency. Sustainable cassava production embodies economic, environmental, social and innovation dimensions (Hennessy *et al,* 2013). Sustainable agricultural development involves ensuring and maintaining productive capacity for the future and increasing productivity without damaging the environment or jeopardizing natural resources (Gold, 2009). Sustainable cassava farming entails improving the quality of life in rural areas, ensuring enough food for the present and future generations and generating sufficient income for the farmers. Sustaining the viability of farm operations is an important economic dimension to sustainable cassava production. The aim of the study is to analyze the factors affecting sustainability of farm level practices among cassava farmers in the study area. The specific objectives are to: describe the socio-economic characteristics of cassava farmers in the study area, estimate the mean of sustainability indicator of farm level practices of cassava farmers in the study area, determine the factors that affect sustainability of farm level practices among cassava farmers in the study area and identify the constraints faced by cassava farmers in the study area.

Research Methods

This study was conducted in Kwara and Nasarawa States of North Central Nigeria. The area is located between Latitudes $06^{0}30^{/}$to $11^{0}20^{/}$N and Longitudes $02^{0}30^{/}$E (Shuaib *et al,* 1997). Majority (77%) of population in the region are rural dwellers and mostly participated in one form of agricultural enterprises or the other (Shuaib *et al,* 1997). The area is characterized by two major seasons, namely, dry and wet seasons. The wet season ranges from April to October while dry season ranges from November to March (Nigeria Meteorological Agency, 2008). The rainfall per annum ranges from 1000 to 1500mm with the average of 187 to 220 rainy days with average monthly temperature ranges from 21^{0}C and 37^{0}C.The vegetation of the region consists of the forest savannah, southern guinea savannah and the northern guinea savannah. Geographically, the zone is characterized by varying landforms such as extensive and swampy features which are common in the lowland areas which occur in the areas along the valleys of Benue and Niger rivers, deep valleys, large hills, mountains and plateaus. Soil and weather patterns are favourable for the production of wide spectrum of agricultural food, industrial and cash crops of difference types. The major crops grown in the North Central Nigeria include rice, millet, maize, sorghum, cassava and yam. The population of Kwara State as of 2006 census was 2.37 million, agriculture is the main source of economy, citizens also engaged on business and civil service, it has land mass area of 36,825,km^2. Nasarawa State has population of 2,040,112million, with land mass area of 27,117km^2, agriculture is the mainstay of its economy, and some others partake in patty business and civil service (National Population Commission, 2006).
A Multistage sampling procedure was used to collect the sample size for this study. Kwara State is divided into four agricultural zones (A,B,C and D) and Nasarawa State is divided into three zones (Southern, Central and Western). In the first stage, three zones (B, C and D) out of four were purposively selected in Kwara State while in Nasarawa State all the three zones were considered which gave a total of six zones. The second stage involved the random selection of one Local Government Area each across the six zones in the study area. In the third stage, three communities from each of the selected LGAs were randomly selected which gave a total of eighteen communities. Following Nwadike (2016), at the fourth stage, 10% of the cassava based crop farmers were proportionately sampled from each community to serve as sample size of two hundred and fifty six (256) for the study. Primary data were collected with the use of structured questionnaire. The questionnaire were administered to the respondents by the researcher who was assisted by well-trained enumerators. Data were collected on input and output such as quantity of cassava produced (in tons), revenue from output (in Naira), size of land cultivated (in hectares), labour input (in man day), interest charge on borrowed capital, rent on land, quantity of planting materials (in kg), herbicides used (in litres), number of extension contact, insecticide (in litres), and fertilizer (in kg). Information were also elicited on the socio-economic characteristics of respondents such as age, gender, educational level, house-hold size, and years of experience in cassava production. Furthermore, data were collected on sustainable farm level practices such as seed sourcing, weed control, crop management, pest and disease control, maintenance of soil fertility, tillage, method of irrigation and drainage system. The following analytical techniques was used, Frequency distribution tables, percentage, arithmetic mean, variance and standard deviation was used to achieved objectives i

and v. Objective ii was achieved through the use of Data Envelopment Analysis (DEA) following Coelli *et al* (2002) and as applied by Alboghdady (2014). The variables for the estimation are data on a single output (Y = 1, cassava) for each of N farms (N=1,2, ……,256) and K inputs (K = 1,2,…..,5) denoting as:

K_1 = Labour (man-days)
K_2 = Cassava stem (kg)
K_3 = Herbicide (litres)
K_4 = Fertilizer (kg)
K_5 = Farm size (ha)

For i^{th} farm, inputs and output data were represented by the column vector k_i and y_i. The data for all N farms are represented by K x N input matrix, k, and Y x N output matrix, y. Hence, the Variable Return to Scale (VRS) input oriented DEA model for the ith farm is specified as follows:

$\text{Min}_{\phi i},i\phi i,$
Subject to $Y\lambda$- yi ≥ 0
$K_i \quad \phi i \quad - \quad K\lambda \quad \geq \quad 0, \quad \lambda \quad > \quad 0$
(1)

Where
Φ is a scalar and λ is a N x 1 vector of constant. The linear programming problem for constant return to scale (CRS) can be easily modified to obtain variable return to scale (VRS) by adding the convexity constraint: N1, λ = 1 so as to minimize the following equation:

$\text{Min}_{\phi i},i\phi i,$
Subject to $Y\lambda$- yi ≥ 0
$K_i \quad \phi i \quad - \quad K\lambda \quad \geq \quad 0, \quad \lambda \quad > \quad 0$
(2)
N1, λ = 1 λ > 0, where N1 is a N x 1 vector of ones. Constant return to scale (CRS) DEA model was applied for this study.

According to Coelli *et al.* (2005), the input technical efficiency score gets a value 0≤ φ ≤ 1. If the φ is equal to one, the farm is on the frontier and then technically efficient.

Objective iii was achieved with the use of farm level practice sustainability indicator model.

Taylor *et al.* (1993) constructed the sustainability indicator model to estimate the mean sustainability of farm level practices in Malaysia. Each farming practice were be simply scored (in absolute terms) with 0, 0.5, 1 or 3 points for each criterion. The scoring system could be interpreted as: 0 indicates no significant impact, 0.5 indicates marginal impact 1.0 indicates significant impact and 3 indicates strong significant impact.

The scores for each holding was calculated by multiplying the "Total scores attributed to each farming practice as follows:(i) Seed sourcing (ii) Weed control (iii)Crop maintenance, (iv) Pest and disease control, (v)Maintenance of soil fertility, (vi) tillage.

In order to achieve objective iii which determined the factors that affect sustainability of farm level practices regression model was used. The implicitly functional form is specified as:

$Y=f(X_1,X_2,X_3,X_4,X_5,X_6,X_7,\ldots\ldots X_n)+e_i$ .... (3)

Where
Y = Mean sustainability farm level practices (dependent variable)
X_1 = Mean technical efficiency
X_2 = Educational level (years spent in school)
X_3 = Access to credit (Dummy variable, 1 for yes, 0 otherwise)
X_4 = Extension visit (Number of times)
X_5= Farm size (ha)
X_6 = Years of farming experience (Number of years)
X_7= House hold size (Number)
e_i = Error term

Results and Discussion

The socio-economic characteristics of respondents such as age, gender, marital status, educational level, household size, farm size, access to credit, method of land acquisition, years of farming experience, membership of cooperative and extension contact were analyzed using simple descriptive statistics are presented in Table 1. Most (79.6%) of the respondents were within the age bracket of 18 to 55years. This is an indication that a large proportion of the cassava farmers in the study area were in their productive years. This situation may have a positive effect for unskilled labour supply in the study area. As agricultural production requires able-bodied active individuals, unskilled labour supply to some extent may not constitute a major constraint to production activities of cassava farmers in the study area. This concurred with the findings of Mgbada *et al.* (2016) on their study of sustainable agricultural practices and its determinants among cassava farmers in South- East Nigeria. Similar study by Onuk *et al.* (2017) on the economics of maize-cowpea intercropping production in Kokona Local Government Area of Nasarawa State showed that labour supply was not a problem as most of farmers were in their economic active age. Most (97.7%) of the respondents were married. Married couples contribute significantly to the general progress of farm enterprises and where wives are given separate portions of land to produce crops; increase in output can be substantially observed. In a similar vein Anzaku *et al.* (2016) observed that marital status play a vital role in farm business if both males and females participate in

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production activities. Educational attainment level of the cassava farmers was relatively high as 82.7% of them had one form of education or the other. This may enhance adoption and utilization of new technologies in cassava production. This is important in increasing cassava output. It will be easier for educated farmers to adopt the latest extension packages in the study area. As pointed by Onuk *et al.* (2017) in their findings, education has positive influence on adoption of innovation that could boost production output of the farmers. The result also concurs with the findings of Nsikan *et al.* (2014) that high rate of education had

Table1: Distribution of Respondents According to Socio-economic Characteristics

Variables	Frequency	Percentage (%)
Age		
Less than 25	3	1.2
25-35	24	9.4
36-45	50	19.5
46-55	119	46.5
> 55	60	23.4
Total	**256**	**100**
Gender		
Male	241	94.1
Female	15	5.9
Total	**256**	**100**
Marital Status		
Married	250	97.7
Single	5	1.9
Widow/Widower	1	0.4
Total	**256**	**100**
Educational Level		
Primary	69	26.9
Secondary	80	31.3
ND/NCE/SH	49	19.1
University	14	5.4
Adult Education	3	1.2
Quranic	15	5.9
None of the above	26	10.2
Total	**256**	**100**
Household size		
1-10	165	64.5
11-20	76	29.7
21-30	11	4.3
>30	4	1.5
Total	**256**	**100**
Farm size		
1-5	242	10
6-10	14	94.5
Total	**256**	**100**
Land acquisition		2.9
Inheritance	193	75.4
Community land	14	5.5
Rented	6	2.3
Lease	33	12.9
Purchased	10	3.9
Total	**256**	**100**
Farming experience		
1-10	55	21.5
11-20	122	47.7
21-30	69	26.9
31-40	10	3.9
Total	**256**	**100**

Source: Field survey data, 2017.

positive impact on cassava output. Labour supply for agricultural production for small-scale producers is usually partly or wholly from household. In Table 1, results showed that 64.5% of the respondents had household size between 1and10. The other cases had household size well over 20 people. This can constitute family labour useful in the production process. Household members are still a source of labour to poor resource farmers in many rural communities. This finding agrees with the findings of Vihi *et al.* (2017) that large household size plays a vital role in labour supply which increases productivity of the poor resource farmers. Table 1 show that 94.5% of the respondents owned farm-land that ranged from 1 to 5 hectares in the study area. Given the small nature of their holdings, cassava farmers were predominately small-scale producers and consequently their output level is expectedly low. This study agrees with the findings of Mgbada *et al* (2016) that cassava farmers were small-scale holders in South-East Nigeria due to nature of their farm holdings. The vast majority (65.2%) of the respondents shown in Table 1 did not have access to credit facilities, thus, small-scale farmers will not have the required funds to purchase improved inputs that could lead to increase in production level.

The various methods of land acquisition by the respondents are presented in Table 1. The experience of 47.7% of the respondents engaged in cassava production ranged from 11 to 20 years. As presented in Table 1, there are cases of many who have been producing cassava in excess of 20 years. Ceteris paribus, experience should have positive correlation with farmers output. This was the view of Edeoghon et al. (2008) that farming experience increases the agricultural production.

The technical efficiency scores of cassava farmers generated through DEA is presented in Table 4.2. Result revealed that 93% of the respondents had a technical efficiency level that ranged between 0.00 and 0.99, while 7% of the respondents had technical efficiency level of 1.00. This is an indication that only 7% of the respondents had achieved fully technically efficient in their production activities in the study area. Furthermore, 0.06 and 1.00 was obtained as minimum and maximum mean efficiency, respectively, with an average mean of 0.61. The remaining 39% is an indication that there is room for enhancing technical efficiency. This study agrees with findings of Mohammed and Tamer (2016), on their study of technical efficiency of cassava production in the savannah zone of Northern Ghana.

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Table 2: Frequency Distribution of Respondents According to Technical Efficiency Level in the Study Area

Efficiency Level	Frequency	Percentage
0.00 – 0.09	2	0.78
0.10 – 0.19		
0.20 – 0.29	1	0.39
0.30 – 0.39	1	0.39
0.40 – 0.49	24	9.38
0.50 – 0.59	48	18.75
0.60 – 0.69	58	22.66
0.70 – 0.79	50	19.53
0.80 – 0.89	39	15.23
0.90 – 0.99	15	5.86
1.00	18	7.03
Total	256	100
Minimum Efficiency	0.06	
Maximum Efficiency	1.00	
Mean Technical Efficiency	0.61	

Source: Field Survey Data, 2017.

Mean sustainable indicators of farm level practices of cassava farmers scores were calculated for each of the 256 respondents in Kwara and Nasarawa States, Nigeria using the sustainability indicator model. The sustainability indicators of farm level practices scores were used to assess the level of farm practices adopted by individual household in the study area.
The scores for each holding was calculated by multiplying the total scores attributed to each farm practices as follows: seed sourcing, weed control, crop maintenance, pest and disease control, maintenance of soil fertility, tillage, method of irrigation and drainage system.
The results shown that no farmer used seed (e.wallet, USAID, etc), part of credit (e.wallet, USAID, etc), natural fertilizer (e.g wood ash), indigenous chemicals, zero tillage (herbicide application), zero tillage (direct, planting), reduced tillage (ploughing, ridging), reduced tillage (harrowing, ridging), surface channel (graded, bedded land, bonded basins, terraces), subsurface drainage systems, regular systems (subsurface drains, sub-soiling) and checked systems (drains with checked systems, well drainage in all cases). Local commercial supply of seeds, manual weed control, bush fallowing, intercropping, mixed farming, natural pest control were practiced to some degree by the farmers and in all cases. All the others were used to limited and sometimes negative extent. The findings suggest that much more work is required to get cassava farmers to adopt all the sustainable practices.
Table 3 presents the mean scores of the adopted sustainable farm level practices among cassava farmers in the study area. The means scores of seed sourcing obtained was 12%, weed control was 2%, crop management was 71%,pest and disease control was 15%, while the means scores of maintenance of soil fertility and tillage were 17% and 3%, respectively. This results agrees with the findings of Lawal *et al.* (2011), in their study of a farm level sustainability indicators for horticultural crops production in Fadama area of Southern Guinea Savannah of Nigeria.
Figure 1 presents the means scores in percentage for the eight categories of farming practices (seed sourcing, weed control, crop management, pest and disease control, maintenance of soil fertility, tillage, method of irrigation and damage system). The score of each farming practice was from zero (0) at the origin to 100% furthest from the origin. The further the score from the origin the better the adoption of the farming practice. The percentage adoption of each of the farming practice was: seed sourcing 10%, weed control 1.6%, crop management 59.2%, pest and disease 12.5%, maintenance of soil fertility 14.5%, tillage 2.5%, method of irrigation 0% and drainage system 0%. Crop management (59.2%) was the best adopted sustainable farm level practice and weed control (1.6%) was the least sustainable farm level practice adopted in the study area. Method of irrigation and drainage were not adopted at all. In the study of Rigby *et al.* (2001) soil fertility maintenance was the most adopted farming practice and seed sourcing was the least adopted farming practice when a similar model of farm level indicators of sustainable agricultural practice was used.

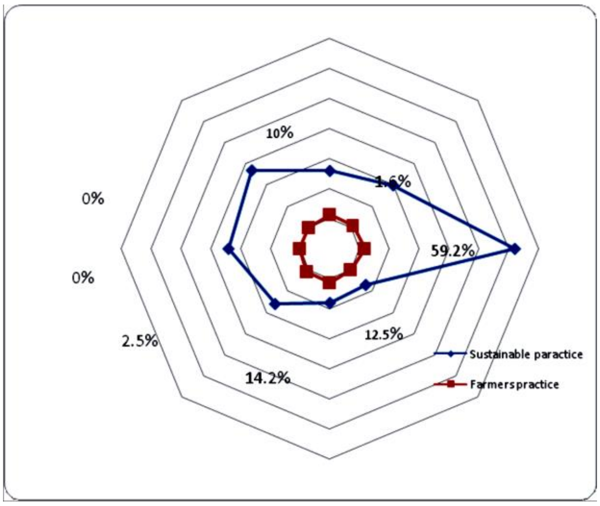

Figure 1: Sustainable and Farm Level Practices of Cassava Production in the Study Area. Source: Field Survey Data, 2017.

Multiple linear regression model was used to examine the factors that affect sustainability of farm level practices among cassava farmers in the study area. The results are presented in Table 4. The estimated parameters with positive signs indicate that variables contributes positively to increase the sustainability of

Table 3: Mean Sustainable Farm Level Practices

Farm Practices	Mean	Percentages
Seed sourcing	12	10
Weed control	2	1.6
Crop management	71	59.2
Pest and disease	15	12.5
Maintenance of soil fertility	17	14.2
Tillage	3	2.5
Total	120	100

Source: Field Survey Data (2017)

farm level practice while negative sign is the reverse. The mean technical efficiency (X1) had expected positive sign and significant at 1% probability level. This implies that a unit increase in technical efficiency led to increase in sustainable farm level practice among the cassava farmers in the study area. This may explain why the increase in technical efficiency led to increase in sustainable farm level practices, because if the farmer is technically efficient it may motive the farmer to sustain the production level. Furthermore, the coefficients of education and extension contact also had expected positive signs and were significant at 1% and 5% probability levels respectively. This is an indication that change in education and extension contact influence the sustainability of farm level practices among cassava farmers in the study area.

On the other hand, years of farming experience had negative sign and significant at 5% probability level. This signifies that as respondents increase in years of farming experience, it led to decrease on the sustainable farm level practices of the respondents.

This study is in conformity with Mgbada et al. (2016) in their study of sustainable agricultural practices and its determinants among cassava farmers in South-East Nigeria.

Results in Table 4, further revealed that 31% of variation of sustainability farm level practices among cassava farmers were caused by the explanatory variables included in the multiple regression model. While 69% was not explained by the explanatory variables. The F-value was 2.45 and significant at 5% probability level, this implies that there is significant relationship between sustainable farm level practices and selected explanatory variables.

Table 4: Regression Estimates of Factors that affect Sustainability of Farm Level Practices

Variables	Parameters	Coefficient	Standard Error	T- value
Constants		2.674	1.435	1.863
Mean technical efficiency	X_1	3.199	1.222	2.617***
Educational level	X_2	3.610	1.605	2.250**
Access to credit	X_3	-6.735E-6	0.000	-0.016
Extension contact	X_4	2.421	0.623	3.885***
Farm size	X_5	1.096	2.695	0.407
Years of experience	X_6	-0.614	0.252	-2.436**
Household size	X_7	-0.983	0.688	-1.429
R2				0.31
F-Value				2.45**

Source: Field Survey Data, 2017.
Note: *** significant at 1% level, ** significant at 5% level and * significant at 10% level.

The study observed that cassava farmers encountered constraints in their cassava production activities. The constraints faced in the study area are presented in Table 5. The results revealed that shortage of extension service (100%) ranked first. It could be that most of the cassava farmers do not have access to latest information in cassava production and especially sustainable farm level practices in the study area. On the other hand, lack of access to credit and price fluctuation (99.2%) ranked second. The absence of credit and unstable prices can affect cassava production significantly. Insufficient markets for outputs (98.4%) ranked third. An insufficient market for output was among the major constraints faced by cassava farmers. Lack of control of inputs supply (96.1%) ranked fourth. Poor producers price (95.7%) and insufficient transportation facilities (95.7%) ranked fifth. Cassava production activities could be hampered by lack of adequate transportation facilities and low producer prices. The findings of Abdullahi *et.al* (2017) also indicated that transportation facilities are important factors that influence youth performance in agriculture as an enterprise. Other constraints include lack of insurance facilities (94.1%), high cost of inputs (92.2%) and inadequate storage facilities (91%) ranked sixth, seventh and eighth respectively. It is cleared from the results that above listed constraints affected farmer's performance mostly. The low ranking of lack of insurance facilities, high cost of inputs and inadequate storage facilities could be due to the fact that cassava farmers in the study area have several means of curtailing them. This finding concurs with Tsado *et.al* (2010) in their study of sustaining extension activities in yam production in Yagba Local Government Area of Kogi State, Nigeria.

Table 5: Distribution of Respondents According to the Constraints Faced in Cassava Production

Constraints	Frequency	Percentage Rank
Shortage of extension service	256	100 1
Lack access to credit	254	99.2 2
Price fluctuation	254	99.2 2
Insufficient market for output	252	98.4 3
Lack of control of input supply	246	96.1 4
Insufficient Transportation facilities	245	95.7 5
Poor producer price	245	95.7 5
Lack of insurance facilities	241	94.1 6
High cost of inputs	236	92.2 7
Inadequate of storage facilities	233	91.0 8
	2462*	

Source: Field Survey Data, 2017.

Conclusion

The study was able to investigate the sustainability of farm level practices among cassava farmers in Kwara and Nasarawa States, Nigeria. Specifically it examined the socio-economic attributes of cassava farmers and estimated the mean sustainability index of farm level practices of cassava farmers in the study after which the factors that affect sustainability of farm level practices among cassava farmers were ascertained. The results revealed that vast majority of the respondents were in their productive years and had one form of education or the other. Finding also indicated that crop management was the best adopted sustainable farm level practice while weed control was the least sustainable farm level practice by the farmers. The farms were fairly efficient and technical efficiency resulted in increase in sustainable farm level practice among the cassava farmers in the study area. Shortage of extension service was the most constraint encountered by respondents while insufficient farm land was the least constraint that faced respondents in the study area. Based on the findings the study concluded that cassava production in Kwara and Nasarawa States was small-scale in nature and that cassava farmers were not fully sustainable in their farm level practices. It was therefore recommended that relevant authorities such as NGOs, government and agricultural extension agents should encourage farmers in the business and the prospective farmers by supplying production resources and improving access to such inputs as capital (farm credit), fertilizer and market access.. This will enhance production, reduce widespread poverty, create job opportunity and better the lives for the citizenry.

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