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Socioeconomic determinants of cocoyam production among small holder farmers in Ekiti state, Nigeria

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Abstract: This study investigated the determinants of cocoyam production among small holder cocoyam farmers in Ekiti State. The study employed stratified random sampling technique to select 90 cocoyam farmers from six communities across the three agricultural zones in the State. Data collected from the respondents were analysed using descriptive statistics, multiple regression and factor analysis. The results obtained from the analyses showed that the average age of cocoyam farmers in the area was 54 years, with majority of them (about 70%) being males. On the level of education of the respondents, about 30% of the farmers had no formal education, while majority (41%) stopped at the primary school level. Virtually all the respondents intercropped cocoyam with crops such as cassava, maize and vegetables The major household level socioeconomic determinants of cocoyam output as revealed by the regression analysis include gender, household size, farm size, farming experience and land ownership status of the farmers. At the societal level, the results of the factor analysis show that the major constraining factors to cocoyam production were economic/institutional factor such as high cost of farm inputs and inadequate extension contacts, techno-infrastructural such as poor storage facilities and lack of access to mechanized services, and socio-financial factor such as land tenure problem and inadequate finance. The foregoing suggests that enhancing access of cocoyam farmers to cultivable land through favourable policies will increase production. In addition, credit facilities should be made available to them in form of soft loans to enable them procure necessary inputs for production. Provision of required infrastructural facilities and education of the farmers through extension services should be made a priority by government for sustained food production.

Keywords: Cocoyam, small holder farmers, constraints, factors, food crops, Ekiti State Nigeria

INTRODUCTION

Nigeria, like some other developing countries is principally an agrarian nation who still face an ever increasing food crisis as the level of food production is yet to keep pace with demand. There is worsening food insecurity, even with massive food importation as evidenced by rising food import bill (Okoye, *et al*, 2008). Akinsanmi (2009) reports that Nigeria is one of the worst hit countries globally given her unprecedented level of acute food shortage and its accompanying ravaging malnutrition. Though endowed with vast expanse of arable land for crop production and fresh waters for fish breeding, reports still show that Africa's largest country cannot produce food crops her population requires and had thus been depending on food importation to meet her domestic demands (Adepoju and Awodunmuyila, 2008).

Cocoyam is an important staple in Nigeria and ranks third in importance after cassava and yam among the root and tuber crops

cultivated and consumed (Echebiri, 2004; Okoye, Asumugba, Okezie, Tanko and Onyeaweaku, 2008). It (either white or pink) is nutritionally superior to cassava and yam, containing 70 - 80% water, 20 – 25% starch and significant amount of vitamins and particularly compatible with the diet requirement of diabetic patients. In addition, its protein content is very high when compared with that of other tropical tuber crops (Onwueme, 1991). It also plays a significant role in bridging the food gap between the time of plenty and scarcity, with all the vegetative parts of used as food in one form or the other.

Cocoyam (*taro*) has broad leaves with long stem attached to a corm which grows into the soil with some cormels (Uguru, 1996). It belongs to two members of the *Araceae* family that are staple foods for many people in developing countries in Africa, Asia and the Pacific (Agueguia, Fatunku and Halm, 1992). It is the most widely grown crop in both western and eastern regions of Nigeria in terms of area cultivated and number of producers, and it is not only a major source of food but also income, especially in the rural areas (Oguniyi, 2008). The two varieties mainly produced in Nigeria according to Edet and Nsikak (2007; and National Root Crop Research Institute 'NRCRI' (2008) are *Colocasia escilenta* (L) Scott (taro) and *Xanthosoma sagittifolium* (L) Scott (tannia). Available data as reported by FAO (2006) and Okoye, Onyeaweaku, Ukoha, Asumugba and Aniedu (2008) show that Nigeria is the world's leading producer of cocoyam with an estimated 3.5 million metric tonnes in 2003. This was about 40% of the world's cocoyam production (Eze and Okorji, 2003).

As a food crop, cocoyam has some inherent characteristics, which makes it attractive to consumers in Nigeria. It has a multiplicity of end uses; for example, it can be used for making starch, flour, soup, confectioneries and so on, in addition to its being consumed in various other forms in which other starchy staples can also be consumed. It is available all the year round, making it preferable to most other root and tuber crops. It is also resistant to drought, pest and diseases, and tolerant to a variety of climatic and soil conditions (Ogunniyi, 2008). The market for cocoyam, particularly in the urban areas is therefore expanding rapidly.

However, as noted by Onyenweaku and Eze (1987) and Zuhair and Hunter (2000), the production of the crop is not encouraging as the yield per hectare is still low. This is particularly, because, the bulk of cocoyam production in Nigeria is in the hands of rural resource poor farmers, who are characterised by small holdings (usually from 0.05 – 3.0 hectares per farmer), low capitalization and low yield per hectare (Olayemi, 1994, Adepoju and Awodunmuyila, 2008).

Expansion in cocoyam production has therefore the potential of bridging the wide demand and supply gap, and enhancing the income (thereby reducing poverty) of the rural farmers, particularly the vulnerable group. Opata (2010) reports that many rural people, particularly women have gained interest in the production, processing and marketing of cocoyam, essentially because of the rapid increase in its share of the urban market in

Nigeria. Previous research efforts on cocoyam were focused on marketing and profit efficiency of the commodity. This is evident in Adepoju and Awodunmuyila (2008) and Ogunniyi (2008). This study therefore estimates the determinants of cocoyam production in the area.

METHODOLOGY

Study Area: The study was carried out in Ekiti State, Southwestern Nigeria. The state is located between longitudes 4^0 45^1 and 5^0 45^1 East of the Greenwich meridian and latitudes 7^0 15^1 and 8^0 15^1 North of the equator. Ekiti State is in rainforest belt with a temperature range of 21^0c to 28^0c and high humidity. Topographically, the state is mainly an upland zone rising above 250 meters above sea level (Ekiti State Government, 2008).

The population of Ekiti State as reported by National Population Commission 'NPC' (2006) is 2,384,212 people with more than 80% of the population engage in farming as main source of livelihood (Olaitan and Oladipo, 2002). It has 16 administrative local government areas divided into three (3) agricultural zones namely: Zone A, B and C. It is suitable for livestock rearing, production of cash crops such as cocoa, coffee, cola nut and food crops such as yam, cassava, cocoyam, plantain and so on (Kuponiyi and Bamigboye, 2009).

Sampling and Data Collection Procedure: Multistage random sampling technique was used in selecting the respondents. Two local government areas were randomly selected from each of the three agricultural zones making six local government areas. From each of the local government area, one community was selected making six communities. With the assistance of key informants, the list and location of cocoyam farmers in each community were compiled from which the sample for the study was drawn. Fifteen (15) farmers were sampled from each of the six communities across the state totaling 90 cocoyam farmers in all. Structured questionnaire was used for data collection. This focused mainly on socio-economic characteristics of the farmers, output of cocoyam in tons, cropping system and constraints militating against cocoyam farmers in the study area. The data for the study was collected in January, 2010.

Measurement of output and area of land: A full basket of cocoyam as a standard unit of measurement in the study area weighs 25kg; therefore, 40 baskets of cocoyam is 1000 kg which is one ton. The area of a heap of cocoyam stand, which is the cultivation method in the study area is 1 x 1 meter. Therefore, since the area of a hectare is 10,000 square meters, a farmer with 1000 heaps of cocoyam has 0.1 ha.

Estimation Procedure: The data collected were analyzed using descriptive statistics, Ordinary Least Squares method and factor analysis as detailed below.

Household socio-economic factors affecting the output of cocoyam was estimated using OLS method. The following is the implicit form of the model:

$Y = (x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8\ e)$.

Where y = output of cocoyam (in tons).

X_1 = Age of the farmers (in years).

X_2 = Sex (Gender) of the household head (male = 1, female = 0).

X_3 = Household size (in number).

X_4 = Years of education of household head (in years).

X_5 =Farm size (in hectares)

X_6 = Farming experience of household head (in years).

X_7 = Land ownership status (owned = 1, otherwise = 0).

X_8 = Unit (a full standard basket) price of cocoyam (in N)

e = Radom error term.

The explicit form of the linear model is as follows:

Yc = b0 + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 + b8x8 + e

Three functional forms: linear, semi-log and double-log were estimated using the Ordinary Least Square (OLS). This was considered necessary in order to select the functional form with the best fit. In the semi-log and double log forms, 0 values in the dummies were replaced with 0.0001. This is because, the number 0 is undefined for log.

Factor Analysis - Exploratory factor analysis was employed in identifying societal factors constraining cocoyam production in the area. Principal component factor analysis with varimax-rotation and factor loading of 0.30 was used. Therefore, variables with factor loading of less than 0.30 and variables that loaded in more than one factors were discarded (Ashley, *et.al* 2006; Madukwe, 2004).

The principal component factor analysis model is stated thus:

$Y_1 = a_{11}X_1 + a_{12}X_2 + * \ * \ *+ a_{1n}X_n$

$Y_2 = a_{21}X_1 + a_{22}X_2 + * \ * \ * + a_{2n}X_n$

$Y_3 = a_{31}X_1 + a_{32}X_2 + * \ * \ * \ * + a_{3n}X_n$

* = *

* = *

$Y_n = a_{n1}X_1 + a_{n2}X_2 + * \ * \ * + a_{nn}X_n$

Where

$Y_1, Y_2 \ldots Y_n$ = observed variables / constraints to cocoyam farmers in the study area.

$a_1 - a_n$ = factor loadings or correlation coefficients.

$X_1, X_2, \ldots X_n$ = unobserved underlying factors constraining cocoyam farmers in their production activities in the study area.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Majority (62%) of the respondents were aged between 41 – 60 years, about 11% fell within 20-40 years; while 27% of the respondents were above 60 years of age (table 1). On the average, the farmers were aged 54 years. This showed that the cultivation of cocoyam was carried out by relatively old farmers. This could be as a result of increased rate of rural-urban drift and the involvement of the youths in commercial motorcycling, popularly known as *okada* in the state; thereby living agricultural production in the hands of old farmers. Evidence from a study conducted by Adetunyi, Olaniyi and Raufu (2007) showed that about 53.3% of farmers in Oyo state, southwest Nigeria were above 50 years of age.

On gender of the respondents, majority (69%) of the farmers were male while 31% were females. This is not an indication that women were less involved in cocoyam production because they are often perceived as subordinate to male authority in male headed households

(Eboh and Ogbazi, 1990, Fakoya, Apantaku and Aderti 2006).

About 30% of the respondents had no formal education while majority (41%) had primary education. About 23% and 6% of them had secondary and higher education respectively. Thus, a greater percentage (71%) of the farmers had either primary or no education. Adepoju and Awodunmuyila (2008) had a similar finding that a total majority of about 60% of cocoyam farmers in Ekiti State had primary and no formal education.

Majority of the respondents (60%) had household sizes ranging from 6 – 10 persons; about 32% of them had between 1-5 persons while 8% fell within the size of 11-15 persons. None of the households had up to 16 persons or above. Amusa (2004) had similar observation while assessing the demand for fuelwood substitutes in Ekiti State that, majority of about 64% of the sampled households in the State had population size ranging from 6 – 10 persons. On farming experience, 30% of the respondents had between 10 - 20 years, while 29% had between 21 - 30 years of farming experience. The farmers that fell within the range of 31-40 years of farming experience represented 24% of the respondents. About 12% fell between 41-50 years, while only 4% of them had over 50 years of experience. On the average, the number of years of farming experience of the respondents was 30 years. Olaitan and Oladipo (2002) noted that Ekiti people depend on land because over 80% of the population was engaged in farming and that their general belief was that farming is the only source of food, wealth, financial security and protection from hunger.

Table 1: Frequency and Percentage Distribution of Socio-Economics Characteristics of the Respondents

Variable	Frequency	Percent
Age		
20-30years	1	1.1
31-40 years	9	10.0
41-50 years	30	33.3
51-60 years	26	28.9
61 and above	24	26.7
Gender		
Male	62	68.9
Female	28	31.1
Education		30.0
No formal education	27	
Primary school education	37	41.1
Secondary school education	21	23.3
Tertiary education	5	5.6
Household size		
1 – 5	29	32.2
6 – 10	54	60.0
11 – 15	7	7.8
Farming experience		
10 – 20years	27	30.0
21 – 30 years	26	28.9
31 - 40 years	22	24.4
41 - 50 years	11	12.2
51 and above	4	44
Total	**90**	**100**

Source: Field Survey 2010

Cropping System

Majority of the respondents (97%) diversified production by having other food crops interplanted with cocoyam in their farms. Most farmers diversify production through intercropping, because of the risks and uncertainties involved in farming (Adegeye and Dittoh 1985; Bishop and Toussaint 1958). About 97% of the farmers interplanted vegetables such as tomatoes, pepper, okra and various species of leafy vegetables with cocoyam while 94%, 91% and 34% of the farmers interplanted maize, cassava and cowpea respectively (figure 1). Only 23% of the farmers interplanted white yam (*Dioscorea rotundata*), while about 28%, 41% and 39% had yellow yam (*Dioscorea cayenensis*), Chinese yam (*Dioscorea opposita*)

and water yam (*Dioscorea alata*) respectively incorporated in their cocoyam farms. The bar chart (Figure 1) further illustrates the pattern of cropping system among cocoyam farmers in the area, showing that yams (*Dioscorea* spps) and cowpea were not commonly interplanted with cocoyam while cassava, maize and vegetables were the food crops mostly intercropped with cocoyam. Maize and vegetables were usually planted about the same time with cocoyam while cassava was introduced latter to avoid shading which could grossly reduce the yield of other crops in the system.

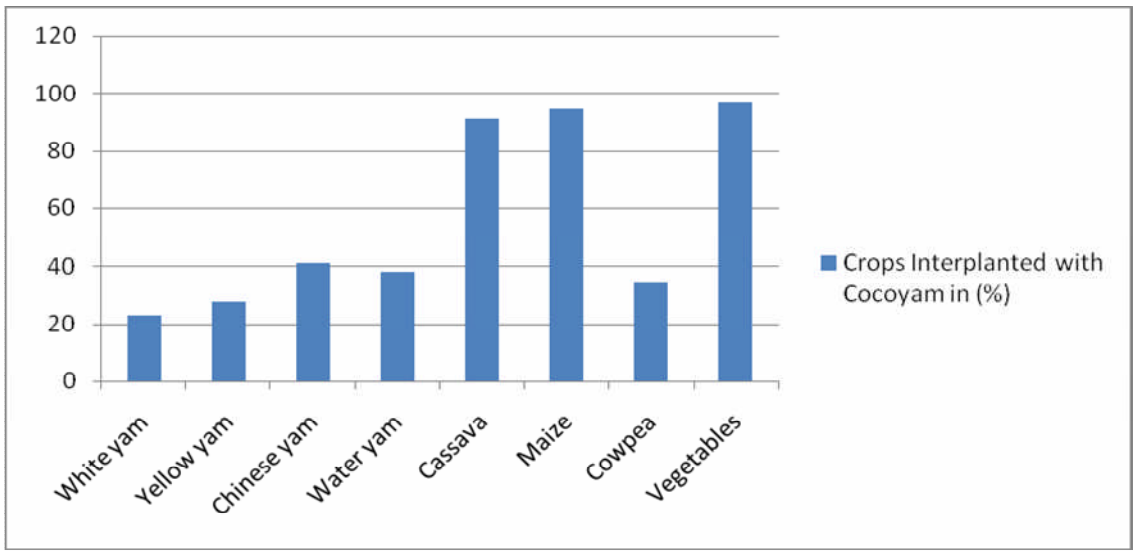

Figure 1: Percentage distribution of Respondents by Crops Intercropped with Cocoyam

Household Socioeconomic Factors Influencing Cocoyam Production

Table 3 presents the results of the regression analysis and it shows that the linear functional form had the best fit, based on the values of R^2 (0.93), level of significance of explanatory variables and their signs. The F-value of (131.646) indicated that the overall equation was significant at ($p<0.01$) while Durbin-Watson (DW) of 1.996, showed the absence of autocorrelation.

Out of the eight explanatory variables specified, five were statistically significant; these were sex, household size, farm size, years of farming experience, and land ownership status of the farmers. Sex of the household head significantly and negatively affected output of cocoyam at ($p<0.01$). This suggests that male farmers perhaps de-emphasize cocoyam production in favour of other food crops such as yam and cassava in the area. The household size was positively and significantly ($p<0.01$) related with cocoyam output. Elasticity of production suggests that a 10% increase in household size will increase production by 3.12% every other thing being equal. As earlier stated, the high rate of rural-urban migration in search of paid employment, or *okada* riding, results in cases of farm labour shortages; such that large households become boost for improved production; easing labour bottlenecks. This finding is in agreement with that of Babatunde, Omotesho and Sholotan (2007) on socio-economic characteristics and food security status

of farming households in Kwara State, North-Central Nigeria where household labour availability improved farm productivity. Oguniyi (2008) in a study on profit efficiency among cocoyam producers in Osun State Nigeria found that households with increased family size exhibited significantly less loss of farm profit than farmers with less family size.

Farm size was found to be significant and positively related to the output of cocoyam in the area ($p<0.01$). This conforms with *a priori* expectations as households with large farm size are more likely to have increased output when compared with households that are constrained by land availability. Elasticity of production suggests that if fame size is increased by 10%, output of cocoyam will increase by 4.03% *ceteris paribus*. Oluyole and Sanusi (2009) had similar findings on a study carried out in Cross River State, reporting that with the desired agronomic/management practices, increased farm size will improve farm output.

Farming experience was also positive and significant ($p<0.01$). This suggests that farming experience is an important determinant of level of output. Farming involves a lot of risks and uncertainties; therefore to be competent enough to handle all the vagaries of agriculture, farmers must have stayed in farming business for quite some time (Ogundele and Okoruwa, 2006).

Ownership of land was positive and significant at 1% level of probability. This is consistent with *a priori* expectation that as farmers own more land, their output is likely to increase all things being equal. Elasticity of production suggests that if farmers' ownership of cultivable land is increased by 10%, output of cocoyam will be increased by 1.39%. The degree of control over land for agricultural production according to FAO (2005) is a central factor affecting farmers' decisions on farm expansion and investment. Adequate availability of cultivable land to farmers has been reported by many authors to have positive relationship with output (Fabiyi *et. al*, 2007).

Table 3: Result of the Multiple Regression Analysis for Socio-Economic Determinants of Cocoyam Output

Coefficient/Variables	Linear {a}	Semi-log	Double-log
Intercept	-0.895 (0.845)	-3.930 (6.137)	-0.367 (0.377)
AGE	0.002 (0.011) b = 0.009	0.734 (0.714)	0.033 (0.101)
SEX	-0.525 (0.188)*** b = -0.101	-0.127 (0.030)***	-0.010 (0.004)**
HHOLD SIZE	0.317 (0.061)*** b = 0.312	1.748 (0.534)***	0.269 (0.076)***
EDU	0.022 (0.024) b = 0.942	0.010 (0.024)	0.002 (0.003)
FMSIZE	4.251	1.538	0.235

	(0.594)***	(0.287)***	(0.041)***
	b = 0.403		
EXPR	0.048	0.851	0.296
	(0.014)***	(0.445)*	(0.063)***
	b = 0.241		
LDOWNERSHIP	0.685	0.111	0.023
	(0.242)***	(0.037)***	(0.0005)***
	b = 0.139		
UNITPRICE	0.001	0.326	0.162
	(0.000)	(0.752)	(0.106)
	b = 0.041		
R^2	0.929	0.861	0.924
Adjusted R^2	0.922	0.847	0.914
F-Value	131.646	62.776	122.598
Durbin-Watson (DW)	1.996	1.919	2.065
Observation	90	90	90

Source: Field survey, 2010
Note: Figures in parentheses are standard errors.
*** denotes p<0.01; ** denote 0.01<0.05; while * denotes 0.05 <p<0.10
{a} is the lead equation based on fitness.

Major Societal Factors Militating Against Cocoyam Production in the Area

Table 4 presents the varimax-rotated factors militating against cocoyam farmers in the area. Three (3) factors were extracted based on the response of the respondents. Only variables with factor loading of 0.30 and above at 10% overlapping variance (Ashley, Amber, and Anthony, 2006) were used in naming the factors. Variables that loaded in more than one factors as in the case of variables 4, 11, 18 and 20 were discarded while variables that have factor loadings of less than 0.30 were not used (Enete and Amusa, 2010). In naming the factors, Kessler (2006) stated that each factor is giving a denomination based on the set of variables or characteristics it is composed of. This procedure was adopted in grouping the variables into three major factors as: economic/institutional factor – factor1, Techno-infrastructural factor – factor2 and socio-financial factor – factor3.

Under factor 1 (economic/institutional factor), the specific variables militating against cocoyam farmers in the area were: high cost of farm input (0.598); inadequate extension contacts (0.371), inadequate access to inputs (0.424), high labour cost (0.443) and poor soil fertility for cocoyam production (-0.453). Fadayomi (1988) stated that high cost of inputs; farm labour and associated low level capital investment in agriculture due to low farm income are some of the major challenges facing most African farmers. Inadequate extension contacts by farmers is one of the institutional challenges facing farmers as Madukwe (1996) noted that ineffective transfer of agricultural technology through extension agents is a major problem facing agricultural development in Nigeria. The challenge of poor soil fertility could still be as a result of financial constraints which limits their application of soil maintenance inputs such as fertilizers.

Variables that loaded under factor 2 (Techno-infrastructural factor) include poor storage facilities (0.352), inadequate or lack of access to mechanized services (0.530); poor technical know-how of most farmers (0.622) and

poor road network in the area (0.326). The problem with Nigerian agriculture is not primarily with production but shortage of infrastructural facilities such as good road to ensure effective distribution of agriculture produce, inadequate storage and processing facilities. Ajibade (2000) confirmed that poor storage and processing facilities are some of the major problems of agriculture in Nigeria. Moreover, Ndubizu (1990) reported that some of the factors that affect crop farmers in Nigeria were inadequacy of modern farm tools and machinery and poor technical knowledge.

Under factor 3 (socio-financial factor) were: land tenure problem (0.750), relatively old age of the farmers (0.409), inadequate finance (0.603) and lack of access to fund to secure farm inputs (-0.464). It has been noted by several authors that socio-cultural beliefs and socio-economic characteristics of farmers play significant role in agricultural production. For instance Ajibade (2000) stated that the type of land tenure system practiced in most Nigerian societies discourage farmers from acquiring lands for agricultural production. The author (Ajibade 2000) reported further that poor financial status of Nigerian farmers is a major limiting factor in agricultural production. The relatively old age of the farmers as one of the major challenges against production in the area could be linked with the reported cases of increased rural-urban migration of youths thereby living agriculture in the hands of their old parents. Okoruwa and Ogundele (2006) stated that as farmers grow old, their productivity tends to decline and this constitutes a major limiting factor to most Nigerians farmers.

Table 4: Varimax-rotated factors militating against cocoyam farmers in the study area

S/N	Constraining variables	Factor 1 Economic/ institutional factor	Factor 2 Techno-Infrastructural factor	Factor 3 socio-financial factor
1	High cost of cocoyam production inputs.	**.598**	-.022	-.196
2	Land tenure or ownership problem.	-.017	.038	**.750**
3	Old age of most cocoyam farmers.	-.041	.240	**.409**
4	Low and fluctuating price of cocoyam in the market	.223	.532**	-.382**
5	Prevalence of pest and cocoyam disease problem.	-.256	-.252	.037
6	Inadequate or lack of extension contacts with the farmers.	**.371**	-.223	-.131
7	Inadequate finance to expand cocoyam farming.	-.209	-.093	**.603**
8	Poor storage facilities.	-.012	**.352**	-.006
9	Low recognition for cocoyam as poor man's food.	-.196	-.205	-.036
10	Inadequate or lack of access to mechanized services.	.121	**.530**	-.094
11	Poor credit accessibility to resource poor farmers.	.378**	-.123	.364**
12	Inadequate access to fertilizer, farm tools, chemicals etc.	**.424**	-.046	-.085
13	High cost of labour supply for	**.443**	.105	-.250

	cocoyam production			
14	Poor technical-know-how in using improved farm methods.	-.020	**.622**	.204
15	Poor soil fertility for cocoyam production in the area.	**-.453**	.074	.261
16	Prevailing unfavourable weather condition against cocoyam production in the area.	.108	.179	.053
17	Lack of access or fund to secure improved planting materials.	.060	-.171	**-.464**
18	Physical problems like erosion and frequent fire disasters.	-.002	-.532**	.576**
19	Poor road network that prevents smooth distributive trade of cocoyam.	-.243	**.326**	-.007
20	Far distance of cultivable land from residential areas.	.334**	-.609**	-.275

Note: Factor loading of **0.30** is used at 10% overlapping variance.
Variables with factor loadings of less than **0.30** were not used.
**Variables that load in more than one factor were discarded

Conclusion and Recommendations

The paper estimated the determinants of cocoyam production among small-holder farmers in Ekiti State Nigeria using multiple regression and factor analysis. Cocoyam farmers in the area had a mean age of 54 years of which majority (70%) were males, with an average of 30 years of farming experience. The major household level socio-economic determinants influencing cocoyam output in the area were gender, household size, farm size, farming experience and land ownership status of the farmers. At the societal level, the identified factors militating against cocoyam production include: economic/institutional factor such as high cost of farm inputs and inadequate extension contacts, techno-infrastructural such as poor storage facilities and lack of access to mechanized services, and socio-financial factors such as land tenure problem and inadequate finance. The foregoing suggests that enhancing access of cocoyam farmers to cultivable land through favourable policies will increase production. In addition, credit facilities should be made available to them in form of soft loans to enable them procure necessary inputs for production. Provision of required infrastructural facilities and education of the farmers through extension services should be made a priority by government for sustained food production.

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