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COMPARATIVE PROFIT AND DETERMINANTS OF NET FARM INCOME AMONG SMALL HOLDER COCOYAM FARMERS IN SOUTH-SOUTH, NIGERIA

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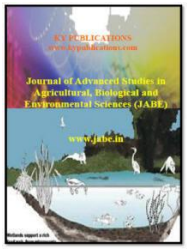

ABSTRACT

This study compared the profitability and determinants of *Colocasia esculenta* and *Xanthosoma sagittifolia* production in South-South Nigeria. The study specifically described the socio-economic characteristics of the cocoyam farmers, estimated the cost and returns in *Colocasia* and *Xanthosoma spp.*production, established the difference in net farm incomes realized by farmers of the two varieties, established the determinants of net farm income realized by the *Colocasia* and *Xanthosoma spp.* farmers, estimated the effects of prices of individual resource inputs and output, as well as the effects of socio-economic factors on per unit profit and identified problems militating against cocoyam production. Multistage, purposive and random sampling techniques were used to select 200 cocoyam (100- *Colocasia* and 100- *Xanthosoma spp.*) farmers for the study. Primary data were collected using structured questionnaire administered by personal interview. Descriptive statistics, enterprise budgeting, multiple and profit function regressions were used for data analyses. Results indicated that *Colocasia esculenta* returned more profit than *Xanthosoma saggitifolium* having yielded a gross margin of ₦5,044,182, net farm income of ₦4,804,782.4, mean net farm income of ₦48,047.82 and net return on investment values of 2.64 as against *Xanthosoma sagittifolium* with a gross margin of ₦4,675,740, net farm income of ₦4,411,905.5, mean net farm income of ₦44,119.05 and net return on investment of 2.30. Cost of inputs, education and farm size had positive and statistically significant influence on net farm income realized by farmers of the two varieties. Profit was significantly influenced by per unit price of output (positively), farmer's age (positively) and per unit price of corms (negatively). The major constraints to cocoyam production in the area were scarcity of improved high yielding corms, lack of capital, high cost of labour, high cost of transportation, lack of storage facilities, diseases and pests. Policy measures such as the prioritization of research into high yielding corms, injection of funds into cocoyam farming through the Bank of Agriculture for farmers to have access to loans (especially the women) at reduced interest rate, provision of modern storage facilities will help to achieve better profit. Also, there is need to encourage younger farmers training through extension programmes for sustained production.

Keywords: Profitability, Gross Margin, Net Farm Income, *Colocasia* and *Xanthosoma spp.*, South-South

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INTRODUCTION

Colocasia esculenta and *Xanthosoma saggitifolium* are the two common varieties of cocoyam grown in South-South, Nigeria. Cocoyam belongs to the monocotyledonous family Araceae known as the Aroids. The name cocoyam is generally applied to a variety of useful and edible species belonging to different genera including Colocasia, Xanthosoma, Alocasia, Crytospema and Amorphophallus (Ugbajah and Uzuegbuna, 2012). Cocoyam, an important staple food crop in Nigeria is ranked third in importance after cassava and yam among the root and tuber crops cultivated and consumed (Okoye *et al*., 2008). It is not only an important staple but also a source of income especially in the rural areas (Adelekan, 2012) where it is grown. As a food crop, it has some inherent characteristics, which makes it special to the farmer in Nigeria: it is rich in carbohydrates, especially starch and consequently has a multiplicity of end uses. The cultivation of cocoyam in most African countries is essentially by smallholder resource-poor farmers with minimal input (Onyeka, 2014). Smallholder farmers, especially women who operate within the subsistence economy grow most of the cocoyam in Nigeria as observed by Okoye *et al.* (2006).

Cocoyam is vegetatively propagated using the corms and to a lesser extent the cormels. When compared to yam in terms of the rural households' purchasing power, cocoyam is relatively lower in price and that makes it a ready alternative for yam during its off-season (Onyeka, 2014). Cocoyam production, marketing and consumption are interwoven enterprises that sustain many rural dwellers in the South-South. As a result of this, cocoyam farming, production and sale contribute substantially to the economy of rural households. Despite the nutritional advantages of cocoyam and its potential for poverty alleviation for thousands of resource-limited farm households, relatively little research attention has been devoted to its production. Consequently, the potentials of cocoyam as an important staple food crop have remained under-exploited. This could be attributed to production constraints such as pest and diseases infestations (Ezenwa, 2010); lack of storage facilities, lack of capital to expand the business, problems associated with land tenure systems (Agwu, 2002; Njoku, 2008). Moreso, the bulk of cocoyam production is in the hands of rural resource-poor farmers characterized by small holdings (Onyeka, 2014).

Expansion in cocoyam production is necessary to bridge the gap between supply and demand and increase the farmers' income since cocoyam production was observed to be highly profitable (Ohajianya, 2005; Adepoju and Awodunmuyila, 2008 and then Azeez and Madukwe, 2010). Nevertheless, Onyeka (2014) observed sharp decline in the gross production values for Nigeria since 2009 due to some production constraints which is why this study is carried out to: identify the socio-economic characteristics of smallholder cocoyam farmers, ascertain the profitability of cocoyam production, determine the effects of prices of individual resource inputs and output, as well as the effects of socio-economic factors on per unit profit and identify the constraints to cocoyam (*Colocasia* and *Xanthosoma spp.*) production in South-South Nigeria. Some hypotheses tested included (i) net farm incomes realized by farmers of *Colocasia and Xanthosoma spp*. are not significantly influenced by their socio-economic characteristics, (ii) net farm incomes realized by the farmers of *Colocasia and Xanthosoma spp*. are not significantly different.

Materials and Methods

The study was conducted in South-South, Nigeria. The climate is essentially tropical and humid with an average rainfall of 220mm – 250mm (evenly distributed through its long wet season), which covers a period of eight months (March – October) and the dry season spanning the months of November to March (Edoumiekumo *et al.*, 2014). Cocoyam (taro) is grown as a sole crop and sometimes in combination with other crops due to the subsistence nature of farming. It is one of the major root crops in the South-South States and plays an important role in the diet, economic and cultural (traditional) life of some people in the South-South

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(Ajie, Chidibelu and Achike, 2015). *Colocasia esculenta* and *Xanthosoma saggitifolium* are the commonly grown types.

Multistage, purposive and random sampling methods were used to select 200 (100- *Colocasia* and 100- *Xanthosoma spp.*) respondents used for the study. Data on the socio-economic variables of the respondents such as age, gender, household size, marital status, educational level, source of income, farming experience, contact with extension agents, available storage facilities; production variables such as farm size, material inputs, labour supply and use, output of cocoyam with their current market prices and cocoyam production constraining variables were collected. The socio-economic characteristics of smallholder cocoyam farmers were achieved using descriptive statistics such as percentages, frequencies and means. The costs and returns of *Colocasia* and *Xanthosoma spp.* and mean net farm income were realized through the use of enterprise budgeting; the determinants of net farm income realized by the respondents was achieved through multiple regression analysis using the four functional forms (linear, exponential, semi-log and double log) and choosing the form that gave the best output in terms of values of the coefficient (R^2). Profit function was used to determine the effects of prices of individual resource inputs and output, as well as the effects of socio-economic factors on per unit profit

Gross Margin and Net Farm Income

Gross margin is the excess of revenue over variable cost (Okoh, Ugwumba and Elue, 2008), while net farm income is the difference between gross margin and total fixed cost. These are mathematically represented as:

GM = TR – TVC

NFI = GM – TFC or TR-TC

NROI = NFI/TC

Where:

GM = Gross Margin

TR = Total Revenue

TVC = Total Variable Cost

TFC = Total fixed Cost

TC = Total Cost

NFI = Net Farm Income

NROI = Net Return on Investment

The profit function model is implicitly specified as follows:

$\prod^* = \prod^*$ (PPO, PPC, PPF, PPL,FFA, FEL, FFE, FHS, EXV)

Where:

$\prod^*$ = Amount of maximum variable profit (₦)

PPO = Per unit price of output (₦)

PPC = per unit price of corms (₦)

PPF = per unit price of fertilizer (₦)

PPL = per unit price of labour (₦)

FAA = Farmer's age (years)

FEL = Farmer's educational level (years)

FFE = Farmer's farming experience (years)

FHS = Farmer's household size (number)

EXV = Extension visits (number of visits per farming season)

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Multiple Regression Model Specification

The multiple regression was used to assess the effects of socio-economic factors of the respondents, namely gender (GEN), age (AGE), marital status (MAS), household size (HOS), educational level (EDU), farming experience (FAE), farm size (FAS), cost of inputs (CIN) and extension visit (EXV) on net farm income. The implicit form of the model is given as:

NFI = f (GEN, AGE, MAS, HHS, EDU, FAE, FAS, CIN, EXV).

Where:

NFI = Net farm income (*Colocasia esculenta* and *Xanthosoma sagittifolium*) (₦)

GEN = Gender (dummy: male = 1, female = 0)

AGE = Farmer's age (years)

MAS = Marital status (dummy: married = 1, otherwise = 0)

HHS = Household size (number)

EDU = Educational level (years)

FAE = Farming experience (years)

FAS = Farm size (hectares)

CIN = Cost of inputs (₦)

EXV = Extension visit (number of times per production season)

The production function was fitted with four functional forms namely linear, exponential, semi-log and double–log. The explicit expressions of the models are:

Linear: NFI = $\beta_0 + \beta_1$ GEN + β_2 AGE + β_3 MAS +β_4 HHS + β_5 EDU + β_6 FAE + β_7 FAS + β_8 CIN + β_9 EXV + e

Exponential: NFI = $\beta_0 + \beta_1$GEN + β_2AGE + β_3MAS +β_4HHS + β_5EDU + β_6FAE + β_7 FAS + β_8 CIN + β_9 EXV + e

Semi–log: In NFI = β_0+ β_1In GEN+β_2In AGE + β_3 In MAS + β_4 In HHS + β_5In EDU + β_6 In FAE + β_7 In FAS + β_8 In CIN + β_9 In EXV + e.

Double –log: NFI = $\beta_0 + \beta_1$InGEN + β_2 In AGE + β_3InMAS + β_4 In HHS +β_5In EDU + β_6 In FAE + β_7 In FAS + β_8 In CIN + β_9 In EXV + e.

The ordinary and transformed values of the dependent and independent variables were fitted into the respective models and analyzed using the MINITAB Statistical Package. The regression output which produced the best result in terms of number of significant parameters, values of F-statistic, coefficient of multiple determinations (R^2) and Durbin- Watson statistic was chosen as the lead equation.

Results and Discussion

From the study, cocoyam production was female dominated (table 1), 69% were female farmers while 31% were male farmers. Reasons could be to support the family income. Majority of the farmers (54.5%) fall within the age range of 46-61years, while 37% were between 30-45years with a mean of 54years. This indicates that cocoyam production was carried out by aged farmers. Farmers had household sizes between 1-16 persons and an average of 8 persons. This development implied availability of family labour for the realization of cocoyam production potentials in the area at reduced cost. Majority of the farmers had a formal education: 27.5% had primary, 35.5% had secondary and 15% had tertiary education. This implies openness to innovations that can result in better utilization of resources for output and profit maximization. Majority (80.5%) of the farmers had 1-10 years of farming experience, 15.5% had 10-20 years and 4.5% had above 21years farming experience with a mean of 7.7years experience. The study further showed that farmers farm sizes ranged between 0.1-0.9 hactare during the farming season.

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Table 1: Socio-economic characteristics of the cocoyam farmers

Variable	Frequency	Percentage (%)
Gender		
Male	62	31
Female	138	69
Total	**200**	**100**
Age		
30 – 45	74	37
46 – 61	109	54.5
62 – 87	17	8.5
Total	**200**	**100**
Mean = 54	**Max = 78**	**Min = 30**
Household Size		
1 – 5	99	49.5
6 – 10	89	44.5
11 – 15	11	5.5
No response	1	0.5
Total	**200**	**100**
Mean = 8	**Max = 20**	**Min = 1**
Education attainment		
Less than 1	44	22
1 - 6	55	27.5
7 - 12	71	35.5
13 - 18	30	15
Total	**200**	**100**
Farming Experience		
1 - 10	161	80.5
10 – 20	30	15.5
21 – 30	7	3.5
Above 30	2	1
Total	**200**	**100**
Mean = 7.7	**Max = 55**	**Min = 1**
Farm Size (Ha)		
Less than 0.1	82	41
0.1 – 0.3	57	28.5
0.4 – 0.6	33	16.5
0.7 – 0.9	18	9
No response	10	5
Total	**200**	**100**
Extension Visit		
No visit	171	85.5
1	16	8
2	10	5
3	3	1.5
Total	**200**	**100**

Source: Field survey, 2015.

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Estimated Cost Structure for Cocoyam (*Colocasia* and *Xanthosoma spp.*) Production

The farmers incurred some costs in the course of cocoyam production. The costs included variable and fixed costs. The variable costs were on item such as corms, labour, fertilizer/organic manure and transportations while the fixed cost items were matchete, hoe, wheelbarrow, spade, storage basket and interest on loans which are not direct cost items to the farmers. Cost structure for the cocoyam farmers is presented in Table 2. The farmer's growing *Colocasia esculenta* spent ₦1,581,418 or 86.85% of their total production cost on variable costs items. Out of this, labour accounted for 43.84% followed by corms with 38.52%, fertilizer 3.44% and transportation the least variable cost (1.02%). A maximum of ₦98,000 and minimum of ₦21,000 was expended by *Colocasia esculenta* farmers during the season.

For growers of *Xanthosoma sagittifolia,* the total cost of production amounted to ₦1,919,894.6. Out of this amount, the total variable cost accounted for (86.26%), leaving only ₦263,834.55 (13.74%) to be shared by the fixed cost items. A maximum of ₦105,000 and minimum of ₦25,200 was expended by the *Xanthosoma sagittifolia* farmers during the season (Table 2). The total cost of cocoyam (*Colocasia and Xanthosoma spp.*) amounted to ₦3,740,712.1 with total variable cost accounting for ₦3,237,478 (86.55%) and fixed cost of ₦503,234.11 (13.45%).

Table 2: Estimated cost structure of Cocoyam Production

	All farmers		*Colocasia spp*		*Xanthosoma spp*	
Variable	**Amount(₦)**	**%**	**Amount(₦)**	**%**	**Amount(₦)**	**%**
Variable input						
Corms	1,465,628	39.18	701,418	38.52	764,210	39.80
Fertilizer	90,000	2.41	62,700	3.44	27,300	1.42
Labour	1,647,450	44.04	798,750	43.87	848,700	44.21
Transportation	34,400	0.92	18,550	1.02	15,850	0.83
Total variable cost (TVC)	**3,237,478**	**86.55**	**1,581,418**	**86.85**	**1,656,060**	**86.26**
Fixed input						
Dep. on Matchete	118,305	3.84	62,003	4.03	56,302	3.65
Dep. on Hoe	150,394.7	4.88	78,980.79	5.13	71,413.92	4.62
Dep. on Wheelbarr	95,628.41	3.10	46,250.77	3.01	49,377.64	3.20
Dep. on Spade	26,256	0.85	10,815	0.70	15,441	1.00
Dep. on basket	20,550	0.67	9,850	0.64	10,700	0.69
Interest on loan	92,100	2.99	31,500	2.05	60,600	3.92
Total fixed cost (TFC) =	**503,234.11**	**13.45**	**239,399.56**	**13.15**	**263,834.55**	**13.74**
Total cost (TVC+TFC)=	**3,740,712.11**	**100.00**	**1,820,817.60**	**100.00**	**1,544,184.55**	**100.00**
Maximum	**203,000.00**		**98,000.00**	**5.38**	**105,000.00**	**6.80**
Minimum	**46,200.00**		**21,000.00**	**1.16**	**25,200.00**	**1.63**

Source: Field survey, 2015. Note: Dep.= depreciation, % = percentage

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Enterprise Budgeting Analysis for Cocoyam

Enterprise budgeting analysis was deployed to determine the profitability of cocoyam production in the study area. The analysis indicating total revenue (TR), total cost (TC), total variable cost (TVC), total fixed cost (TFC), gross margin (GM), net farm income (NFI), mean net farm income (MNFI), net return on investment (NROI) classified according to *Colocasia* and *Xanthosoma* are presented in Table 3. *Colocasia esculenta* generated a gross margin of ₦5,044,182, net farm income of ₦4,804,782.4, mean net farm income of ₦48,047.82 and net return on investment values of 2.64 while *Xanthosoma sagittifolia* generated a gross margin of ₦4,675,740, net farm income of ₦4,411,905.5, mean net farm income of ₦44,119.05 and net return on investment of 2.30. This means that for cocoyam production in the South-South, every ₦1 invested would have a return on investment of ₦2.64 for *Colocasia esculenta* and ₦2.30 for *Xanthosoma sagittifolia* respectively. The entire farm generated a gross margin of ₦9,719,820. Thus, in the study area, cocoyam farming having recorded a positive net farm income was a profitable enterprise. Cocoyam farming has also been adjudged a profitable enterprise in previous studies conducted in Southeastern Nigeria by Asumugha and Mbanaso (2006) and (Ugwumba *et al.,* 2013), and in the Southwest by Ogunniyi (2008).

Table 3: Estimated profit for cocoyam production

	All farmers		***Colocasia spp***		***Xanthosoma spp***	
Variable	**Amount(₦)**	**%**	**Amount(₦)**	**%**	**Amount(₦)**	**%**
Total Revenue	**12,957,300**		**6,625,500**		**6,331,800**	
Variable input						
Corm	1,465,628	39.18	701,410	38.52	764,210	38.90
Fertilizer	90,000	2.41	62,700	3.44	27,300	1.76
Labour	1,647,450	44.04	798,750	43.87	848,700	54.96
Transportation	34,400	0.92	18,550	1.02	15,850	1.03
Total variable cost (TVC)	**3,237,478**	**86.55**	**1,581,418**	**86.85**	**1,656,060**	**86.26**
Fixed input						
Dep. on Matchete	118,305	3.84	62,003	4.03	56,302	3.65
Dep. on Hoe	150,394.7	4.87	78,980.79	5.13	71,413.92	4.62
Dep. on Wheelbarrow	95,628.41	3.05	46,250.77	3.01	49,377.64	3.20
Dep. on Spade	26,256	0.85	10,815	0.70	15,441	1.0
Dep. on basket	20,550	0.66	9,850	0.64	10,700	0.69
Interest on loan	92,100	2.98	31,500	2.05	60,600	3.92
Total fixed cost (TFC)	**503,234.11**	**13.45**	**239,399.56**	**13.15**	**263,834.55**	**13.74**
Total cost (TVC+TFC) =	**3,740,712.1**	**100**	**1,820,817.6**	**100**	**1,919,894.6**	**100**
Gross margin (GM=TR-TVC)	**9,719,822.0**		**5,044,182**		**4,675,740**	
Net farm income (NFI=TR-TC)	**9,216,587.9**		**4,804,782.4**		**4,411,905.5**	
Mean net farm income MNFI=NFI/n	**46,082.94**		**48,047.82**		**44,119.05**	
Net return on investment NROI=NFI/TC	**2.46**		**2.64**		**2.30**	

Source: Field survey, 2015. Note: Dep.-Depreciation, %- Percentage

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Determinants of Net Farm Income Realized by *Colocasia* and *Xanthosoma Spp.* Farmers

The multiple regression analysis was adopted to predict the effects of producer's socio-economic factors (predictors) on net farm income realized by cocoyam (*Colocasia* and *Xanthosoma spp.*) farmers. The predictors used were cost of input (COI), gender of the producers represented by GEN, age (AGE), marital status (MAS), household size (HHS), education level (EDU), farming experience (FAE), farm size (FAS), and extension visit (EXV). Four functional forms of the regression model (linear, exponential, semi-log and double-log) were fitted with the data and ran using the MINITAB statistical package. Net farm income of the linear regression analysis for cocoyam (Table 4 and Table 5) gave the best output in terms of values of the coefficients, R^2, adjusted R^2, and Dubin-Watson statistics and appropriateness of signs of the regression coefficients, and was therefore chosen as the lead equation. The equation is given as:

NFI (*Colocasia esculenta*) = 45153 + 20962COI + 2773GEN – 2223AGE + 2672MAS – 1766HHS + 48850EDU – 2258FAE + 13766FAS + 11321EXV

And

NFI (*Xanthosoma sagittifolium*) = 65167 + 30992COI + 793GEN – 3223AGE + 3472MAS –786HHS + 55850EDU – 1155FAE + 13939FAS + 321EXV

A total of nine regressors were included in the models. Three of them (cost of input, education and farm size) were statistically significant at the 5% probability level for both *Colocasia esculunta* and *Xanthosoma sagittifolium* while six were not significant. Among the statistically not significant variables, gender, marital status and extension visit exerted positive influence on net farm income while the impact of age, household size and the farmer's farming experience were negative for both species.

For both varieties, the coefficient of cost of input was positive and statistically significant at 5% level of probability. This is against *a priori expectation*. Cost of input is expected to have an inverse relationship with net farm income as observed by Ugwumba *et al.* (2013). The implication is that the high cost of input lead to high output prices. The coefficient of education of the farmers was positive and statistically significant at 5% probability level, meaning that the more educated cocoyam producers were able to acquire better management skills that enabled them to earn higher net farm income than the less educated farmers. This is in agreement with Ugwumba *et al.* (2013). The coefficient of farm size had a positive and statistically significant influence on net farm income in accordance with *a priori* expectations. This meant that the more the number of hectares of land used in production, the higher the output and net farm income, hence agreeing with Ugwumba (2011) which reported same positive relationship between farm size and production output but contrary to the findings of Ogunniyi (2008).

The coefficient of multiple determinations (R^2) of 78.7% and 77.7% obtained for both varieties respectively implied that 78.7% and 77.7% variations in the net farm income for the respective varieties were accounted for by the predictor variables; hence the remaining 21.3% and 22.3%, for the different varieties were due to random disturbances. The Durbin-Watson statistic value of 1.82 for *Colocasia* and 1.78 for *Xanthosoma spp.*, which lies within the benchmark of 2.0, signifies the absence of autocorrelation among observations of the regressors. The F-statistic values of 12.99 for *Colocasia* and 14.79 for *Xanthosoma spp.* indicated that socio-economic characteristics of farmers of the different varieties did significantly influence net farm income. Thus, the rejection of the null Hypothesis I, "net farm incomes realized by *Colocasia* and *Xanthosoma spp.* farmers is not significantly influenced by their socio-economic characteristics namely gender, age, marital status, household size, education, farming experience and extension visit to farmers" and acceptance of the alternative.

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Table 4: Estimated determinants of net farm income realized by the *Colocasia* farmers

Predictor	Linear	Exponential	Semi-log	Double-log
Constant	45153	3.2251	323314	1.9136
	(1.67)	(1.32)	(-1.47)	(4.03)
COI	20962	0.05714	105442	1.1136
	(3.59)**	(2.24)**	(2.18)**	(2.84)**
GEN	2773	0.003513	4756	0.0333
	(1.24)	(0.66)	(0.71)	(1.34)
AGE	-2223	-0.00138	-2357	-0.472
	(-0.74)	(-0.72)	(-0.64)	(-0.51)
MAS	2672	0.0064	3365	0.0896
	(1.56)	(0.56)	(0.56)	(1.08)
HHS	-1766	-0.0071	-17664	-0.033
	(-0.32)	(-0.48)	(-1.48)	(-0.14)
EDU	48850	0.000145	57765	0.3088
	(3.89)**	(1.56)	(3.13)**	(2.31)**
FAE	-2258	-0.0023	-30326	0.0452
	(-0.76)	(-1.22)	(-1.24)	(0.62)
FAS	13766	0.00786	2441	0.2146
	(4.57)**	(3.15)**	(2.11)**	(3.16)**
EXV	11321	0.02311	3146	0.0726
	(1.19)	(1.58)	(0.58)	(0.82)
R^2	78.7%	73.8%	76.3%	75.5%
R^2(adj)	76.4%	71.1%	73.7%	74.4%
F-statistic	12.99	8.12	7.23	8.13
Durbin-Watson Stat.	1.82	1.77	1.76	1.79

Source: Computed from survey data, 2015. Notes: **Significant at 0.05. Figures in ( ) are t-ratios. COI, GEN, AGE, MAS, HHS, EDU, FAE, FAS, EXV are as earlier defined. Durbin-Watson stat. = Durbin-Watson statistic

Table 5: Estimated determinants of net farm income realized by the *Xanthosoma* farmers

Predictor	Linear	Exponential	Semi-log	Double-log
Constant	65167	4.1241	376814	2.7132
	(1.79)	(18.32)	(-1.17)	(5.06)
COI	30992	0.06814	188642	0.2856
	(4.39)**	(2.05)**	(2.38)**	(3.04)**
GEN	793	0.001213	6756	0.0563
	(0.54)	(0.56)	(0.61)	(1.15)
AGE	-3223	-0.00167	-2667	-0.052
	(-0.44)	(-0.42)	(-0.54)	(-0.31)
MAS	3472	0.0082	3365	0.0896
	(1.46)	(0.74)	(0.56)	(1.08)
HHS	-786	-0.0082	-13622	-0.013

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	(-0.20)	(-0.58)	(-1.48)	(-0.07)
EDU	55850	0.000145	8965	0.3049
	(2.89)**	(1.14)	(2.13)**	(2.11)**
FAE	-1155	-0.0023	-30176	0.0342
	(-0.93)	(-0.82)	(-1.14)	(0.32)
FAS	13939	0.00956	2448	0.2496
	(5.40)**	(2.13)**	(3.11)**	(3.87)**
EXV	321	0.00711	2746	0.0866
	(0.19)	(0.58)	(0.38)	(0.78)
R^2	77.7%	72.5%	75.3%	74.5%
R^2(adj)	74.7%	70.1%	72.7%	72.6%
F-statistic	14.79	7.12	6.23	10.13
Durbin-Watson Stat.	1.78	1.67	1.76	1.81

Source: Computed from survey data, 2015. Notes: ** Significant at 0.05. Figures in ( ) are t-ratios. COI, GEN, AGE, MAS, HHS, EDU, FAE, FAS, EXV are as earlier defined. Durbin-Watson stat. = Durbin-Watson statistic.

Difference in the Net Farm Incomes of *Colocasia* and *Xanthosoma Spp.* Farmers

The hypothesis (ii), net farm income realized by the *Colocasia and Xanthosoma spp.* farmers in the study area are not significantly different was tested with paired-samples t-test using MINITAB Statistical Package. The result is shown in Table 6 and indicates that there was significant difference between the mean net farm incomes realized by the *Colocasia and Xanthosoma spp.* farmers in the study area at 10% probability level. Hence, the rejection of the null hypothesis and acceptance of the alternative. This implies that farmers earned more income from *Colocasia* than *Xanthosoma* in the market probably due to its varied usage.

Table 6: Test of hypotheses about differences in mean net farm incomes between *Colocasia* and *Xanthosoma* farmers

Variety	N	MNFI (₦)	Difference b/w means	t
MNFI of *Colocasia*	100	48,047.82		
MNFI of *Xanthosoma*	100	44,119.05	3,928.77	1.79**

Source: Computed from survey data, 2015. Notes: MNFI = Mean net farm income.
**Significant at 0.1. P ≤ 1

Profit Function Regression Result

The profit function was used to estimate the effects of prices of individual resource inputs and output as well as the effects of socio-economic factors on per unit profit. The nine independent variables included in the model were per unit prices of output (PPO), per unit price of corms (PPC), per unit price of fertilizer (PPF), per unit price of labour (PPL). Others are the socio-economic factors including farmers age (FAA), farmer's education level (FEL), farmer's farming experience (FFE), farmers household size (FHS), and extension visit (EXV). Result of the analysis as shown in Table 7 indicated that three of the variables (per unit prices of output, corms and farmers age) were statistically significant at 5% probability level. Per unit price of output had a positive and significant relationship with per unit profit. This is according to *a priori* expectations and meant that high output price would enhance income and profit of cocoyam production. Ugwumba (2011) and Omojola (2014) reported a statistically significant and positive relationship between output and profit of catfish and yam respectively in Anambra State and the Southwest of Nigeria. The coefficient of per unit price of corms was negatively correlated to per unit profit and statistically significant at 5% level (t = -2.43, P =

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0.001). This result is in consonance with *a priori* expectations and implies that high cost of corms would increase total cost of production and hence a drastic reduction in revenue and net farm income. The result of cost of corms accounted for 39.18% (Table 2) of total production cost confirming the above claim.

The coefficient of age had positive and significant influence on profit at 5% probability level. This implied that the older cocoyam farmers utilized their experience and accumulated capital to achieve better productivity and earned higher profit. The coefficients of other variables (such as per unit price of fertilizer, farmers' education level and household size) were negatively correlated to net farm income (profit), while per unit price of labour, farming experience and extension visit had positive relationship with per unit profit but were not statistically significant. The R^2 value of 58.1% indicated that about 58.1% of the variation in profit was accounted for by the independent variables and the rest 40.9% was due to random disturbance. The F- statistic and Durbin-Watson statistic values were significant, indicating overall significance of the regression and absence of autocorrelation respectively.

Table 7: Estimated determinants of maximum variable profit

Predictor	Coefficient	St. Dev.	t
Constant	24.01	47.08	0.51
PPO	32.43	0.054	4.03*
PPC	-4.467	0.848	-2.43*
PPF	-0.30489	0.085	-0.52
PPL	0.01377	0.01137	1.21
FAA	12.266	0.1554	1.98*
FEL	-0.1737	0.5921	-0.29
FFE	0.7180	0.5724	1.25
FHS	-0.986	1.789	-0.55
EXV	0.272	7.046	0.45
R-sq =	58.1%		
R-sq(adj) =	55.5%		
F-statistic =	23.79	(P = 0.000)	
Durbin-Watson =	1.87		

Source: Computed from survey data, 2015. Note: * significant at 0.05. P ≤ 1

Constraints to cocoyam production in the area were scarcity of improved high yielding comels, high cost of labour, lack of capital, poor storage facilities, high cost of transportation, use of traditional techniques, diseases and pests' attacks and scarcity of land. Analysis of the problems according to degree of seriousness is shown in Table 8. Scarcity of improved high yielding corms were indicated by the respondents as the most serious constraint to production of the two cocoyam varieties with mean scores of 2.99 and 3.18 for *Colocasia* and *Xanthosoma* varieties respectively. Other challenges are indicated as shown on the table.

Table 8: Constraints to cocoyam production in the area

Factor	*Colocasia* Mean score	Rank	*Xanthosoma* Mean score	Rank
Scarcity of improved high yielding corms	2.99	1st	3.18	1st
High cost of labour	2.89	2nd	2.80	4th
Lack of capital	2.82	3rd	3.17	2nd
Lack of storage facilities	2.78	4th	2.77	6th
High cost of transportation	2.71	5th	2.92	3rd

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Use of traditional technique	2.57	6th	2.53	8th
Disease and pests	2.38	7th	2.53	5th
Land scarcity	2.37	8th	2.59	7th

Source: Field survey, 2015

Conclusion and Recommendations

Cocoyam production enterprise *(Xanthosoma sagittifolium* and *Colocasia esculenta)* in the South-South States was a profitable venture with the *Colocasia esculenta* enterprise yielding more profit to the farmers. Policy measures to encourage research into high yielding corms, making use of household for labour in the farmland under cultivation will mitigate the problems identified by this study to have militated against production efforts of the respondents and will generate more profit.

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