Economic Analysis of Cocoyam Production in Enugu State, Nigeria

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Abstract

This study examined the status of cocoyam in Enugu State, Nigeria. Cocoyam is ranked after cassava and yam as an imp]ortant staple food crop among the roots and tubers cultivated and consumed in Enugu State. In Enugu State, the benefits of cocoyam and its role in the economy and livelihood of millions of rural poor have been under-estimated, under-reported and poorly appreciated; hence cocoyam production has received less attention by researchers and policy makers. The objectives of the study are to: examine the socio-economic characteristics of the respondents in Enugu State, examine the profitability of small-scale cocoyam producers, and analyze profitability determinants among cocoyam farmers. Purposive and multi-stage sampling techniques were adopted for this study for the selection of 180 respondents. Data collected were analyzed using relevant econometric and other statistical tools. The study shows that the mean age of the respondents was 48years as average farming experience of the cocoyam farmers was 16.17years. The result shows that average educational means is 13.6years as average income is ₦193,545. Annual net profit of cocoyam farmers in the area was N466, 405.79. In conclusion, the research shows that majority of cocoyam farmers cultivated the root crop for household consumption and local sales. The implication is that less cocoyam is produced for export. Development and distribution of improved cocoyam cultivars by the government to the farmers is the recommendation from the study.

Keywords: Cocoyam, Production, Households

1.0 Introduction

Across the world today, the issues of ending world hunger, eradication of poverty, the assurance of food and nutrient security have remained on the front burner influencing her policies over the years. This led to making eradication of poverty as sustainable development goal (SDG) 1 the fundamental of the world policy agenda. This may be achieved through the production of cocoyam especially in African soil – particularly in Nigeria and even in Enugu State. In Nigeria, cocoyam is ranked after cassava and yam as one of the most important staple food crop among the roots and tubers cultivated and consumed in the country.

With about 40% of the total world production, Nigeria is the largest producer of the crop in the world as reported by FAOSTAT (2021). Cocoyam is not only a major source of food but also an important source of income and employment to rural farming households according to Nzeh, et.al (2014). Meanwhile, it is of interest to note that among root and tuber crops in Nigeria, cocoyam is the only fully edible of all parts. In Nigeria statistics shows that production of cocoyam in some town and communities of Southeast Nigeria is gendered culturally regarded as women's crop and immortalized with annual festivals that bore its name such as "*Ede Aro*" and/or "*Ede Opoto*". Over the last decades, the cultural activities involving cocoyam include but not limited to cooking and serving of cocoyam meal to family members, friends and august visitors.

In Nigeria, the benefits of cocoyam along with the wide adaptability of the crop and its role in the economy and livelihood of millions of rural poor have been under-estimated, under-reported, and therefore poorly

appreciated .A study across the nation shows that those who depend heavily on the crop for survival – the most vulnerable groups – have neither the resources nor the voice to influence its future. As reported by Jervis (2021), it is possible that cocoyam farmers face certain constraints that may hinder them from going into the cultivation of cocoyam on a commercial scale. In Nigeria, some of the critical challenges of cocoyam production include - inadequate capital, lack of credit, storage problem, high transportation, seasonality, long distance to market and bad road.

Finally, several research works including that from Nzeh et.al (2014) among others reported that ineffectiveness of existing cooperative societies in rural areas, lack of collateral to secure available credit facilities, poor access to information, lack of sufficient farming experience to tackle climate exigencies and poor access to weather forecast information are equally listed as serious problems of cocoyam production in Nigeria. Meanwhile, recent studies that dwelt on cocoyam production were not conducted in Enugu state. These include the works of Nwoye (2019) and Onoja, (2018); Nwoye, (2019) worked on the economics of cocoyam production by small-holder farmers in Anambra state, while Onoja (2018) studied the efficiency of cocoyam production under traditional small-scale farmer-managed irrigation schemes and rain-fed systems in Kogi state. Therefore rationale for this research is to bridge the gap(s) involve in under-estimation, under-reporting, and poor appreciation concerning cocoyam production in Enugu state. This is because cocoyam production aid in income and employment generation in the rural areas of the nation especially in the study area.

With a view to identifying the variable factors that influence the profitability of cocoyam production and drawing implications on farmers' income and welfare, based on these, the following questions were raised: - What are the socio-economic characteristics of the respondents? What are the factors that influence the output of cocoyam famers? How profitable is cocoyam production? What are the factors that affect profitability of cocoyam farmers; and what are the constraints associated with cocoyam production in the study area?

1.1 Objectives of the Study
The broad objective of this study is to carry analysis of cocoyam production performance in Enugu state, Nigeria. Specific objectives are to: examine the socio - economic characteristics of the respondents in Enugu State, identify factors that influence the output of cocoyam famers, examine the profitability of small scale cocoyam producers in the study area, analyze profitability determinants among cocoyam farmers in Enugu State and identify the constraints associated with small scale cocoyam production in the study area.

Hypotheses of the Study
In line with the research objectives, the following null hypotheses were tested in this research:

Ho_1: Cocoyam production is not profitable in the study area

Ho_2: Socio-economic factors do not significantly have influence on the profitability of cocoyam in the study area

1.2 Justification for the Study
Prior to the global adoption of the 17 sustainable development goals (SDGs) in 2015, the United Nations millennium development goals (MDGs) had as its key goal the reduction of hunger and poverty and to achieve this all aspects of food production will be involved including cocoyam production. Therefore, data obtained will encourage entrepreneurs and farmers to invest in the production of cocoyam. This research is also justified because, it will encourage women, unemployed and potential producers to discover and explore cocoyam's business opportunities. Furthermore, this research is vital as it will equally provide the much needed micro and macro level data and the empirical basis for products and market planning, policy formulation and implementation. This study will be of high interest to the literate producers and producers of cocoyam as to ascertain the profitability of the enterprise and how to improve in the quality of production. The result of this work will help government policy makers in formulating policies that will encourage cocoyam production in Enugu state and Nigeria at large.

2.0 Literature Review

2.1 Conceptual Framework

Cocoyam can be used as food for man and feed for animals. Cocoyam is not only a major source of food but also an important source of income and employment for the rural farming households. Despite its nutritional qualities and the potentials to improve the livelihoods of many smallholder farmers, the crop's output and profitability had dwindled as a result of certain constraints and socio-economic factors which the study seeks to explore.
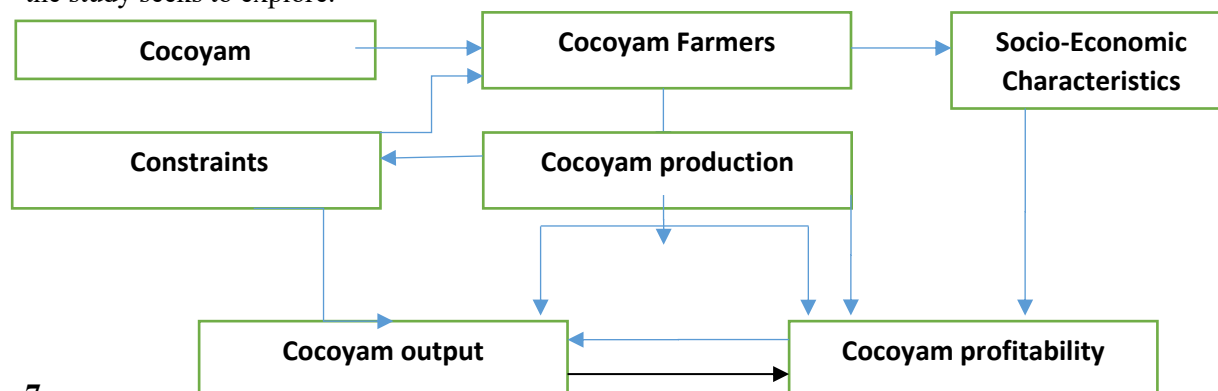
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Figure 2.1: Conceptual Framework (Author's concept, 2021)

Cocoyam can be used as food for man and feed for animals, and mucilage which can be utilized in the paper industry or possibly in medicinal tablet manufacture. Cocoyam can be used as a source of power (Adepoju and Awodunmuyila, 2018).). The major cocoyam producing areas are located in the humid zones and the production relies on small farmers having 0.5 – 2.0 ha in production. The production area has decreased drastically during the last few years, from 30,000 ha in year 2001 to 13,000 ha in year 2021, a decrease that is mainly due to diseases, and unstable prices. Cocoyam is not only a major source of food but also an important source of income and employment for the rural farming households (Nzeh, et.al2014). Despite its nutritional qualities and the potentials to improve the livelihoods of many smallholder farmers, the crop's output and profitability had dwindled as a result of certain constraints and socio-economic factors which the study seeks to explore.

2.2 Global cocoyam production outlook from 2000 to 2019

In many parts of the world, roots and tubers such as cassava, sweet potato, yam, and cocoyam are important staple crops. They are commonly cultivated by smallholder farmers and used as food security and income crops especially in Africa and even in Nigeria.

Table 1.Top ten (10) countries producers of cocoyam in 2019

Global Rank	Country	Total Production (Tons)	Percent of Global Production
1	Nigeria	2,860,909	27.14
2	Cameroon	1,909,738	18.12
3	China (mainland)	1,908,830	18.11
4	Ghana	1,518,436	14.40
5	Papua New Guinea	271,981	2.58
6	Madagascar	226,438	2.15
7	Burundi	217,510	2.06
8	Rwanda	171,803	1.63
9	Lao People's DR	154,644	1.47
10	Central African Republic	140,957	1.34
	Rest of the world	1,160,668	11.00
	World	10,541,914	100.00

Source: Authors' Compilation from FAOSTAT (2021)

According to FAOSTAT (2021), in 2019 major cocoyam producing countries from Africa, America, Asia and Oceania regions. In Africa, Nigeria is the highest producer of cocoyam globally with about 2.86 million

tonnes and 27.14% share of world total production while Maldives had the least production level of 8 tonnes. Globally, cocoyam production in terms of total area harvested has increased substantially in the last two decades, moving from 1.40 million tonnes in 2000 to 1.96 million tonnes in 2019. Asian region had its highest average yield of cocoyam in 2019 from Palestine (37.00 tons/ha) while the average yield of 9.60 tons/ha from Madagascar was Africa's highest according to FAOSTAT (2021). From the Americas, the highest average yield was from St. Lucia (25.00 tons/ha) while the highest yield of Oceania was 17.57 tons/ha from Kiribati. The increased production level noticed in the African region depended largely on increased farmland for cocoyam cultivation rather than increased crop yield per hectare.

2.2 Economic importance of cocoyam in Nigeria

Cocoyam (*Colocasiaesculenta and Xanthosomamafafa*) is important carbohydrate staple food particularly in the southern and middle belt areas of Nigeria. Nutritionally cocoyam is superior to cassava and yam in the possession of higher protein, mineral and vitamin contents in addition to having more digestible starch. Cocoyam which ranks third in importance and extent of production after yam and cassava is of major economic value in Nigeria (Okonkwo et al., (2021). Edible cocoyam cultivated in the country is essentially species of *Colocasia* (cocoyam) and *Xanthosoma* (tannia). The average production figure for Nigeria is 5,068,000mt which accounts for about 37% of total world output of cocoyam. Small scale farmers, especially women who operate within the subsistence economy grow most of the cocoyam in Nigeria even in Enugu State (Ubalua, 2020).

Table 2: Status of cocoyam in South East States of Nigeria

State	Total No. of farm families	2021 cocoyam production in ('000 tons)	Proportion (%) of farm families in cocoyam production	Estimated no of cocoyam farm families
Abia	309,199	142.38	35	108,220
Anambra	447,454	137.80	35	156,609
Ebonyi	384,855	247.80	35	134,699
Enugu	443,973	228.98	35	155,391
Imo	475,460	142.61	35	166,411
South East Total	2,060,941	899.57		721,330
National Total	**18,176,082**	**2,957**		**2,449,640**

Source: Authors' Compilation (2022)

2.3 Theoretical studies

Agricultural production economics is concerned primarily with economic theory as it relates to the producer of agricultural commodities (Ifeanyi-Obi. Togun, Lamboll, Adesope and Arokoyu, 2017). The theory underpinning this research is the managerial efficiency theory of profits and the firm, maximization and production theory

3. 0 Research Methodology

This study is limited to Enugu State. Enugu State was created out of the old Anambra State during the 1991 state creation in Nigeria. Enugu State is bounded on the east by Ebonyi State, on the north by Benue and Kogi States, on the south by Abia State and west by Anambra State. It occupies an area of about 8,022.95km^2 (Ezike, 1998) and has a population of about 3,257,298 (NPC, 2020).

3.1 Sampling Procedure

Purposive and multi-stage sampling techniques were adopted for this study. This was done to ensure that only respondents involve in cocoyam production are involve in the research. In the first stage, three of the six agricultural zones in the state were chosen purposively. In the second stage, was purposive selection of three LGAs from the already selected three agricultural zones giving us 9LGAs.The third stage involved the random selection of four communities each which gave us 36 communities. Finally, from the 36 communities, five respondents each were randomly selected given us 180 respondents for the study.

3.2 Data Collection

Data for this study were collected from primary source. Primary data were obtained by the use of structured questionnaire administered on the selected cocoyam producers. The reliability and validity of the instrument was done before administering them to the respondents. Also, secondary data were sourced from relevant publications which include: text-books, bulletins, periodicals, journals, annual reports, seminar papers etc.

3.2.1 Multiple Regression Model

The model that was used to determine the output of cocoyam (in kg) is specified as follows:

$Y = b_o + b_1 X_1 b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + \ldots + \mu$

Where;

Y = quantity of cocoyam produced (kg)

X_1 = age of farmers (years);

X_2 = sex of farmers (female =1; male=0);

X_3 = marital status

X_4 = educational level (years in formal school)

X_5 = farm size (hectare)

X_6 = farmers experience (years)

X_7 = household size (number of persons under one roof)

X_8 = labour (number of labourers)

X_9 = annual income (Naira)

B = coefficient of explanatory variables,

μ = error terms.

3.2.2 Gross margin analysis

Mathematically gross margin analysis was expressed as:-

Gross margin (GM) = TR – TVC …………..…………………….(1)

NFI = GM – TFC OR TR –TC …………..………………………..…(2)

NROI = NFI/ TC …………………………………………………...(3)

Where

GM = Gross margin

TR = Total revenue

TVC = Total variable cost

NFI = Net farm income

TC = Total cost

TFC = Total fixed cost

NROI = Net returns on investment.

4. 0 Results and Discussion

4.1 Socio-economic characteristics of cocoyam farmers

The major socio-economic characteristics of cocoyam farmers covered by the survey are presented. These characteristics relate to age, gender, marital status, occupational experience, level of education and household size, household composition, farm size, dependency ratio and income etc.

4.1.1 Distribution of respondents according to age

Table 4.1: Distribution of respondents according to their age

Age (years)	Frequency	Percent	Mean
≤10	0	0	
11-20	0	0	
21-30	0	0	
31 40	21	11.6	
41-50	33	18.3	47.91
51-60	53	29.4	
61-70	58	32.2	
≥71	15	8.3	

Source: Field Survey, 2022.

In table 4.1 above, the study shows that the mean age of the respondents was 48 years, thus revealing the presence of respondents that are economically active. This agrees with Nwafor, (2018) who states that age has been found to determine how active and productive a farmer would be. From the preliminarily study, it was found out that majority of the cocoyam producers in the study area starts from the age of 30years or more, as this form the bases of age categorization from that. Also, these age brackets have easy access to land than others below them for cocoyam farming.

4.1.2 Distribution of respondents according to experience
Table 4.2: Distribution of respondents according to their experience

Primary occupational experience (years)	Frequency	Percent	Mean
≤10	77	42.7	
11-20	65	36.1	
21-30	21	11.6	16.17
31-40	13	7.2	
≥40	4	2.2	

Source: Field Survey, 2022.

Farming experience is an important factor in determining both the productivity and the production level. From the table 4.2, it indicated that the result shows that majority (42.7%) of the cocoyam farmers had farming experience that is ≤10years, but the average farming experience of the cocoyam farmers was 16.17 years. This agreed with Okoye, et.al (2018) that number of years of experience could improve skill and better approaches to farm business practices.

4.1.3 Distribution of respondents according to educational level
Table 4.3: Distribution of respondents according to educational level

Educational Level	Frequency	Percent	Mean
No formal education	11	6.1	
Primary	104	63.9	13.6
Secondary	48	26.6	
Tertiary	17	9.4	

Source: Field survey, 2022.

The educational level distribution of the respondents is important in socioeconomic study because it gives an idea on how ones' educational inclinations or level can harness economic potentials in terms of increased production efficiency.

However, as shown in table 4.3 above 93.8% of cocoyam farmers in the study area were literate possessing divers' formal educational levels ranging from primary school education to tertiary school education. Meanwhile, the mean value of the educational level in the study area is 13.6.

4.1.4 Distribution of respondents according to household size
Table 4.4: Distribution of respondents according to household size

Household size	Frequency	Percent	Mean
≤ 5	58	32.2	
6 – 8	97	53.9	6
≥ 9	25	13.9	

Source: Field survey, 2022.

Majority (53.9%) of cocoyam farmers had household size of between of 6-8 persons, but its mean number is 6 which can be seen in table 4.4 above. Research shows that larger households have the tendency to misallocate resources (due to family need pressure), increase (non-budgeted) expenditures which may result to paying less concerns to farming business especially in cocoyam production.

4.1.4 Distribution of respondents according to annual income
Table 4.5: Distribution of respondents according to annual income

Annual Income (₦)	Frequency	Percent	Mean
≤100,000	23	12.7	
100,000 – 500,000	121	67.2	₦193,545
500,001- 1,000,000	34	18.9	
≥1,000,000	2	1.1	

Source: Field survey, 2022.

The total income of the respondents is important in socioeconomic study because it is a proxy to the cocoyam farmers' economic strength. The result on income from table 4.5 above revealed that majority of rural non-farm cocoyam farmers (67.2%) earn between ₦100,000 and ₦500,000 with an average of income of ₦193,545. It is widely recognized that as the income of the cocoyam farmers improves, production increases. According to FAO (2018), low income adversely affects farming households' production level because it leads to low capital investment. Income into the households can come from various sources including income from farm and from other livelihood activities engaged by the cocoyam farmers.

4.2 Yield comparism and factors that influence the output of cocoyam farmers in Enugu State
Table 4.6: Distribution of Independent T test Comparism of yield for corms and leaves harvested under different cropping system

	Corms yield (kg/ha)		Leaves yield (kg/ha)	
Cropping system	**Mono croppers**	**Mixed croppers**	**Mono croppers**	**Mixed croppers**
Mean	7890.7	5134.6	525.9	697.2
Std. Dev.	1117.6	1218.5	183.2	322.0
CV (%)	15.87	20.36	41.78	43.17
t test	2.56***		3.15***	
Overall mean yields				
Mean	6619.2		582.43	
Std. Dev.	1213.1		253.4	
CV (%)	18.62		32.79	
*1 bag of corm = 80kg; 1 Bundle/roll of leaves = 0.35kg				

Source: Field survey, 2022.

On the average, the corm yield was approximately 6619kg per hectare (6.6mt/ha) whereas the average yield of cocoyam leaves was approximately 582kg per hectare (0.58mt/ha). This is consistent with national yield range between 6.3-6.8mt/ha according to (Olukosi and Isitor, 2021). The table 4.6 also shows that 'pure stand' producers obtained higher average corm yield of 7890kg per hectare or 7mt/ha as compared to an average corm yield of 5134.6kg per hectare (5.1mt/ha) for producers intercropping cocoyam with other crops on the same piece of land.

4.2.1 Factors that influence cocoyam production output
Table 4.7: OLS multiple regression analysis of determinants influencing cocoyam production output

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**T-value**	**Sig.**
(Constant)	49012.891	11901.492		0.261	0.301
Age (years)	4910.121	9201.859	0.115	1.604***	0.009
Sex	-8291.491	30733.141	-0.149	-2.369	0.219
Marital Status	29401.712	5905.490	0.490	2.395	0.417
Education	3991.391	1401.191	0.202	1.021**	0.000
Farm size	411.384	9312.050	0.305	2.500	0.604
Farming Experience	49104.711	5141.962	0.019	3.011***	0.0602
Household Size	8315.261	7543.103	0.294	1.159	0.138
Amount Labour	-0.210	4921.403	-0.019	-0.920	0.502

Annual Income	0.745	6341.188	0.391	1.305**	0.000
Adjusted R^2	0.725				
R^2	0.720				
F Statistic	13.05***				

Source: Field survey, 2022.

4.3 Relationship between the Socio-economic Characteristics of cocoyam farmers and their Output

The relationship between some socio-economic variables (such as age, marital status, sex, level of education, farm size, years of experience, household size, amount of labour and annual income) and the output of the respondents was determined using the OLS regression analysis as shown in table 4.7. To estimate the relationship, the study adopted four functional forms were adopted (linear, exponential, semi-log and Cobb Douglas). The Double-log equation was selected as the lead equation based on the value of the R Squared, number of significant variables and conformity with *apriori* expectations. The R^2 value (0.720) shows that the explanatory variable in the model explained 72% of the total variations in output of cocoyam farmers.

The result of the OLS regression analysis revealed that experience and age were significant at 0.01 while education and annual income were significant at 0.05. The coefficient of farming experience (49104.711) is positive, strong and statistically significant at 99.0% coefficient level. The sign of the variable is in conformity with *apriori* expectation. This indicates that increasing farming experience would increase the farm output since the farmer knows the nooks and cranny of the business, so we expect higher productivity. It thus, corroborates the findings of (Okoye et al., 2018) that increasing farming experience enhances efficient use of resources by small scale farmers in Nigeria.

The coefficient of age (4910.121) was positive, marginal and statistically significant at 99% level of confidence. The sign of the variable is in tandem with *apriori* expectations. It implies the higher the age of the cocoyam farmers, the higher their cocoyam production output. According to Oladejo and Sanusi, (2018), older farmers are considered better production risk in the sense that they are rational decision makers and have established reputation in the community on proper farm practices thereby increasing output. The coefficient of farmers' income (0.745) is positive, strong and statistically significant at 95% level of confidence. The positive sign of the variable is in consonance with *apriori* expectations. This indicates that, the higher the farmers' income, the higher his production performance in terms of increased output. The result supports the outcome of Omotesho, et.al (2020) that increased income would place the farmer on a good pedestal for higher levels of business.

The coefficient of level of education (3991.391) is positive, strong and statistically significant at 95% level of confidence. The sign of the variable is in consonance with *apriori* expectations. It implies that, the higher the education status of a farmer, the more informed and reformed he is in achieving better productivity and as such, there will be increase in farm output.

4.3 Profitability of small scale cocoyam farmers
Table 4.8: Estimation of Costs and Returns from cocoyam production

S/N	Description	Quantity	Unit price	Total value (₦)	% Cost
1.	Quantity of cocoyam seed offered as gift (kg)	45.8	338.07	15,483.61	
2.	Quantity of cocoyam seed consumed (kg)	77.2	338.07	26,099.00	
3.	Average quantity sold (kg)	1986.9	338.07	671711.28	
4.	Average quantity purchased (kg)	2109.9	338.07		
5.	Total Revenue (₦)			713,293.89	
6	Variable Costs(VC) (₦)				
7.	Hired Processing labour			17,173.4	24.33
8.	Transportation			19,321.5	27.37
9.	Packaging materials			1l, 420.3	16.18
10.	Maintenance/Repairs			7,468.2	10.58
11.	Interest on Operating Capital			15,211.2	21.55

12.	**Total Variable Costs (TVC)**	**70,594.6**	**100.0**
	Fixed Costs (FC) (₦) Depreciated over three years		
13.	Wheel barrows	15,000.0	8.51
14.	Baskets	13,294.3	7.54
15.	Basins	18,324.2	10.39
16.	Jute/Polythene bags/storage	18,352.7	10.41
17.	Mats	12,143.3	6.89
18.	Production Stalls	69,453.6	39.40
19	Interest on Investment Capital	29,725.4	16.86
20.	**Total Fixed Costs (TFC)**	**176293.5**	**100.0**
20b	**Total Costs : (TFC) + (TVC)**	**246888.1**	
21.	Gross margin: (5) – (12)	**642,699.29**	
22.	Net Farm Income (Profit) (5) – (20b)	**466,405.79**	
26.	Return Per Naira invested in Cocoyam Production (5/20b)	2.89	
27	Net return on investment (22/20b)	1.89	

Source: Field Survey, 2022

Table 4.8 gave summary of annual costs and returns from cocoyam production by farmers in Enugu State. The table 4.7 shows that the returns from cocoyam production to cocoyam farmers were quite high and encouraging to the enterprise. The estimated mean annual Gross Margin was N642, 699.29 to cocoyam farmers. The estimated mean annual net profit was N466, 405.79. Each naira invested in cocoyam production yielded N2.89k to the cocoyam farmers in the area.

4.4 Profitability determinants among cocoyam farmers

Table 4.9: Estimate of factors affecting profitability of cocoyam farmers

Independent variable	Linear	Exponential	Double log	Semi log
Constant	305583.4 (0.51)	-1.67e+07 (-0.75)	14.9094 (0.76)	-287983.2 (-0.95)
Sex	-185657.3 (-1.08)	0.2606564 (1.05)	-0.4081065 (1.09)	-481216.2 (1.14)
Age	14474.19 (0.09)	0.222483*** (2.90)	1.928989* (1.93)	1044816 (0.93)
Marital status	-273027 (-1.02)	0.3201883 (0.51)	-0.7486112 (-0.80)	-85056.08 (-0.08)
Production experience	-19062.69 (-0.32)	1.58e-06 (1.34)	-0.4247507 (-1.12)	-307382.3 (-0.72)
Educational level	21796.9 (0.31)	1.053168* (1.82)	0.4634029 (1.36)	1071359*** (2.79)
Price of product	1.077598*** (4.14)	0.6335164** (2.38)	1.534902 (1.03)	123679.396 (0.39)
Access to credit	-28876.23 (-0.19)	-0.4249028 (-0.62)	0.4753938 (0.23)	41397.21 (0.57)
Household size	23792.91 (0.35)	-.3150659 (-1.24)	0.0166301 (0.03)	-326876.7 (0.56)
Labour cost	-3.01439 (-0.03)	0.0002762 (0.54)	.7636542 (0.74)	3654985*** (3.12)
Transportation cost	-2.636934 (-1.16)	-1.801492* (-1.65)	-1.837498 (-0.93)	-3785062* (-1.70)
R square (R^2)	0.8367	0.9659	0.5943	0.8532
Adjusted R^2	0.8277	0.9403	0.2624	0.8091
F-ratio	5.84***	37.78***	1.79*	19.37***

Source: Field Survey, 2022***, **, * indicate variables are significant at 1.0%, 5%, and 10% risk level respectively. Figures in parenthesis are the t-ratio

The result of the multiple regression analysis models on the factors that influenced the profitability of cocoyam farmers in Enugu State, Nigeria, is shown in table 4.9. The result shows that all the functional forms (linear, exponential, semi-log and double log) of the regression were statistically significant at 1.0%. Meanwhile, the profit equation shows that exponential functional form which explained 96.59% of the total variation at 1.0% was best fitted as their numbers of significant coefficients are in conformity to *a priori* expectations. The F-statistic value of 37.78 is statistically significant at 1.0 alpha level, suggesting that the R^2 is significant and the estimated linear regression equation has goodness of fit.

Specifically, the coefficient of age of the cocoyam farmers (0.222483) was positive and statistically significant at 99.0%. The sign of the variable is in consonance with *a priori* expectation. This implies that the older the cocoyam farmers, the more experience gained in production, hence, increased in net return.

The coefficient of transportation cost (-1.801492) was negative and statistically significant at 10.0% alpha level. The sign is in accordance with *a priori* expectation. This implies that the higher the transportation cost incurred in cocoyam production, the lower the profit of the cocoyam farmers. This result supports the findings of (Omotesho et al., 2020) that as variable cost increases, reduced inputs are used and hence low income.

The coefficient (0.6335164) of the price of cocoyam was positive and statistically significant at 5.0% alpha level. This suggests that the profit arising from the sale of cocoyam would increase as the price of the product increases. This result is in consonance with (Onoja, 2018 and NRCRI, (2012)) who obtained similar result in his study of economic efficiency of processed palm oil production. However, the positive coefficient of educational level (1.053168) was statistically significant at 10.0% risk level. This implies that the profit realized from the business increases as the literacy level of the farmers' increases.

4.5 Constraints associated with small scale cocoyam production

Cocoyam producers are faced with myriad of constraints which directly and indirectly weigh down on production improvement and livelihood of producing cocoyam farmers as shown in table4.12 based on five-point Likert scale.

Table 4.10: Distribution of respondents according to constraints facing cocoyam producers in Enugu state

Constraint	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean score	R
Production related							
High cost of labour	98 (54.4)	45 (25.0)	13 (7.2)	18 (10.0)	6 (3.3)	4.14	1
High incidence of weeds	87 (48.3)	36 (20.0)	38 (21.1)	10 (5.6)	9 (5.0)	4.12	2
High labour intensity	82 (45.6)	44 (24.4)	31 (17.2)	15 (8.3)	8 (4.4)	3.59	3
Limited access to suitable land	76 (42.2)	62 (34.4)	21 (11.7)	12 (6.7)	9 (5.0)	3.45	4
Labour scarcity	67 (37.2)	56 (31.1)	14 (7.8)	20 (11.1)	23 (12.8)	3.10	5
Low soil fertility	37 (20.6)	43 (23.9)	34 (18.9)	36 (20.0)	30 (16.7)	2.63	6
Category Mean		3.93					
Socio-economic related							
High perishability of leaves	68 (37.8)	51 (28.3)	27 (15.0)	16 (8.9)	18 (10.0)	4.12	1
Inadequate capital to invest	57 (31.7)	56 (31.1)	42 (23.3)	16 (8.9)	9 (5.0)	4.06	2
Limited access to credit	48 (26.7)	41 (22.8)	38 (21.1)	27 (15.0)	26 (14.4)	4.01	3
High interest rate on available credit	43 (23.9)	40 (22.2)	22 (12.2)	19 (10.6)	56 (31.1)	3.87	4
Category mean		4.17					
Economic related							
Unpredictability of produce price	45 (25.0)	38 (21.1)	27 (15.0)	26 (14.4)	44 (24.4)	4.05	1
Poor road infrastructure	51 (28.3)	39 (21.7)	42 (23.3)	32 (17.8)	16 (8.9)	4.00	2
High cost of transport to market	37 (20.6)	28 (15.6)	26 (14.4)	37 (20.6)	52 (28.9)	3.74	3
Low prices in accessible markets	29 (16.1)	42 (23.3)	28 (15.6)	32 (17.8)	49 (27.2)	3.32	4
Category mean		3.74					
Overall Constraint Score		3.97					
Krippendorff's Alpha (Kα)	0.64	LL95%CI=0.5161		UL95%CI=0.565			

Source: Field Survey, 2022; Note: R=Rank

5.0 Summary, Conclusion and Recommendation

Summarily, the study shows that 31.1% of the farmers cultivated cocoyam mainly for sale while 61.1% cultivated the root crop equally for household consumption and sale Furthermore, the research shows that on the average, the corm yield was approximately 6619kg per hectare (6.6mt/ha) whereas the average yield of cocoyam leaves was approximately 582kg per hectare (0.58mt/ha)in the study area.

Finally, the results from the study revealed that the estimated mean annual gross margin was N642, 699.29 to cocoyam farmers. But the estimated mean annual net profit was N466, 405.79.This implies that each naira invested in cocoyam production yielded N2.89k to the cocoyam farmers in the area.

In winding up this research, the study concluded that majority of cocoyam farmers cultivated the root crop for household consumption and sale. Meanwhile, the study concluded that experience, age, education and annual income significantly influenced output of cocoyam producers in the study area as returns from cocoyam production to cocoyam farmers were quite high. The study could see that the most constraining production factor in cocoyam production was 'high cost of labour.

The study recommend among others that the use of improved planting materials (early maturing and high yielding) is crucial to ensuring the profitability of cocoyam in the study area. The study proposes that more men be encouraged to get involved in cocoyam production through education and periodic sensitization about the profitability of the crop.

The study also recommends an improved access to extension services by cocoyam famers to increase yield. Through this, recent agricultural technologies and innovations can be passed on to cocoyam farmers for adoption so as to improve yields and income.

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