

Analyzing the Socio-Economic Characteristics, Resource Utilization, and Production Challenges Faced by Cocoyam Farmers in Enugu State, Nigeria.

Abstract

This study analyzes the socio-economic characteristics, resource utilization, and production challenges faced by cocoyam farmers in Enugu State, Nigeria. Utilizing a sample of 100 respondents from five local government areas (Nsukka, Udi, Igbo Etiti, Nkanu East, and Ezeagu), the study employs descriptive statistics, regression analysis, and ranking techniques to analyze the data. Findings reveal that most cocoyam farmers are middle-aged and possess limited formal education, with 40% having only secondary education, which limits their exposure to modern agricultural practices. Cocoyam yield averages 8 tons per hectare, but input use remains minimal, with an average of 120 kg of fertilizers per hectare. High input costs and inadequate access to credit are significant challenges impacting their farming practices and outputs. A resource use efficiency analysis reveals that inputs such as farm size ($R=1.30R = 1.30R=1.30$), herbicides ($R=155.97R = 155.97R=155.97$), fertilizer ($R=28.24R = 28.24R=28.24$), and seeds ($R=3601.39R = 3601.39R=3601.39$) are underutilized, while labor is overutilized ($R=-0.77R = -0.77R=-0.77$). Additionally, farmers face production constraints such as high incidences of pests and diseases, further hindering productivity. The study emphasizes the need for targeted interventions to optimize resource use, increase access to affordable inputs, and improve the livelihoods of cocoyam farmers in the region.

Key words: Cocoyam production, Resource use efficiency, Socio-economic characteristics, Production constraints and Agricultural inputs

INTRODUCTION

Cocoyam (*Colocasia* spp. and *Xanthosoma* spp.) is a vital staple food crop in Nigeria, contributing significantly to the nutrition and food security of rural households. In Enugu State, cocoyam is particularly important due to its adaptability to the local agro-climatic conditions and its role in the local diet. Nigeria accounts for 40% of total global production, making it the largest producer of the crop in the world according to FAOSTAT (2021). Cocoyam is not only a major food crop but also an important source of income as well as employment to rural farming households in Nigeria as mentioned by Nzeh, *et.al* (2014). It is therefore highly interesting to note that among other root and tuber crops cultivated in Nigeria, only cocoyam produces edible parts throughout its life cycle.

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. Socioeconomic factors such as age, level of education and ownership of land and physical inputs like fertilizer, herbicide, cocoyam seeds and land were positive in their influence on cocoyam output (Audu, *et. al* 2022). Though, however, there have been recent studies on cocoyam production specifically 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

Comment [Adeola Ba1]: There is need to reframe this sentence, it would be better if a cited statement introduces this paragraph

Comment [Adeola Ba2]: Using "however" is not appropriate. it will be better starting with words or phrases like "Different studies on cocoyam ..."

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 under-estimation, under-reporting, and under-assessment of cocoyam production in Enugu State. This is because cocoyam production helps in generating income and employment opportunities in rural areas of the country most especially in the study area. This study aims to provide a comprehensive analysis of the socio-economic characteristics of cocoyam farmers, the influence of input utilization on their productivity, and the key constraints limiting production. By doing so, the study will offer valuable insights for policymakers and stakeholders seeking to enhance the cocoyam farming sector in Enugu State.

Comment [Adeola Ba3]: This is year 2024, all references here are more than 5 years ago, please kindly find recent studies or you change the opening sentence to indicate that, there is a gap as the next sentence has indicated.

STATEMENT OF PROBLEM

Cocoyam farming has long been an important agricultural activity for many rural households in Enugu State, Nigeria, the critical role cocoyam plays in rural livelihoods, especially as a staple food and income source. Despite its importance, cocoyam production in Nigeria, particularly in southeastern states like Enugu, faces significant challenges, such as limited access to modern farming techniques, inadequate inputs, and poor resource utilization. According to These challenges lead to suboptimal yields and productivity, which is further exacerbated by socio-economic factors like low literacy levels among farmers, gender-based roles in agriculture, and limited access to extension services. Existing research, as seen in similar studies, highlights that cocoyam farming is predominantly undertaken by women, with most farmers falling within middle-age groups, indicating a labor-intensive process. Issues such as the unavailability of improved varieties, resource limitations (land, labor, capital), and external factors like climate variability and market accessibility further constrain production (Ukwuet *al.*, 2022). Therefore, the problem that needs addressing is how these socio-economic characteristics and resource challenges are interrelated and affect cocoyam production, and how improved agricultural practices and policies can be designed to enhance productivity in Enugu State.

Comment [Adeola Ba4]: This statement of problem is not robust enough, need to have statistical and qualitative evidence to indicate the problem the research is aimed at

OBJECTIVE OF THE STUDY

The broad objective of this study is to Analyze the Socio-Economic Characteristics, Resource Utilization, and Production Challenges Faced by Cocoyam Farmers in Enugu State, Nigeria. while the Specific Objective are to:

- I. describes the socio –economic characteristics of the cocoyam farmers.
- II. examine the influence of input on the output of cocoyam
- III. estimate resources use efficiencies in cocoyam production
- IV. describe the constraints facing cocoyam farmers in the area.

Comment [Adeola Ba5]: please kindly restate this objective to specify what you are looking for in the relationship between the inputs and outputs

SIGNIFICANCE OF THE STUDY

This study is significant for several reasons. First, it will provide up-to-date information on the socio-economic characteristics of cocoyam farmers in Enugu State, which is crucial for understanding their farming practices and challenges. By examining factors such as farmers' age, education, farm size, and access to credit, the study will provide insights into how these socio-economic variables influence cocoyam production. Second, the study will analyze the impact of

input utilization on cocoyam output, providing evidence on how improved access to inputs such as fertilizers, improved seeds, and pest control measures can enhance productivity. This will offer policymakers and agricultural extension officers' evidence-based recommendations on how to improve input distribution and usage among cocoyam farmers. Finally, by identifying the key constraints facing cocoyam farmers, the study will help inform the design of targeted interventions that address these challenges. Stakeholders, including government agencies, non-governmental organizations, and development partners, can use the findings to prioritize investments in rural infrastructure, extension services, and credit facilities. This will ultimately contribute to increasing cocoyam production, improving rural incomes, and enhancing food security in the region.

Comment [Adeola Ba6]: There's need to have qualitative evidence to support this section

Methodology

STUDY AREA

Enugu State is in the southeastern region of Nigeria and is known for its diverse agricultural activities, including the cultivation of cocoyam. The state is endowed with a favorable climate and fertile soils, making it conducive for various crops. The geographical coordinates for Enugu State are approximately 6.4483° N latitude and 7.5139° E longitude. Enugu State has an estimated population of approximately 3.3 million people, according to the National Population Commission of Nigeria (NPC, 2023). Enugu State comprises 17 local government areas (LGAs), which are Enugu East, Enugu North, Enugu South, Igbo Etiti, Isi Uzo, Udi, Oji River, Nkanu East, Nkanu West, Ezeagu, UzoUwani, Awgu, Ngwo, Obollo-Afor, Aninri, Enugu West, Nsukka Agricultural Activities in Enugu State, cocoyam is one of the major crops cultivated alongside other staple crops such as cassava, yam, maize, and vegetables. The agricultural practices in the region predominantly involve subsistence farming, where farmers grow crops primarily for household consumption and local markets. Cocoyam is particularly important in this area due to its nutritional value and adaptability to local soil conditions. Farmers often practice crop rotation to improve soil fertility and control pests. Intercropping: Cocoyam is frequently intercropped with maize, cassava, and vegetables to maximize land use. Some farmers also engage in small-scale livestock farming, including poultry, goats, and sheep, which supplement their income and provide manure for crop production.

SAMPLE TECHNIQUE

A multi-stage sampling technique will be employed for this study. The first stage involved purposively selecting of five (5) local government areas (LGAs) within Enugu State known for significant cocoyam production namely: Nsukka, Udi, Igbo Etiti, Nkanu East and Ezeagu. In the second stage, random sampling was used to select 5 communities each from the chosen LGAs. Finally, in the last stage, a simple random sampling method was applied to select 100 cocoyam farmers from the identified communities. This approach ensures that the sample is representative of the farming population while allowing for the inclusion of various socio-economic backgrounds.

SAMPLE SIZE

The study will target a total sample size of 100 respondents (cocoyam farmers) to ensure adequate representation and reliability of the findings. This sample size is deemed sufficient to provide meaningful insights into the socio-economic characteristics, input utilization, and production constraints faced by cocoyam farmers in Enugu State.

ANALYTICAL TOOLS

The following analytical tools was used to analyze the collected data:

Descriptive Statistics: To summarize and describe the socio-economic characteristics of the cocoyam farmers, including age, gender, education level, and household size. This will involve the use of measures such as frequencies, percentages, means, and standard deviations to analyze objective I, while production function analysis was used to achieve objectives ii and III using double log. While the objective IV was analyzed by Ranking and Mean Score Analysis: To identify and rank the production constraints faced by cocoyam farmers. This will involve asking respondents to rate various constraints on a Likert scale (e.g., from 1 to 5) and calculating the mean score for each constraint to determine the most pressing issues.

The form of the function Double-Log Regression

Double log: $\ln Y = \ln \alpha + \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \dots + X_n + e$

Where:

Y = output of cocoyam (kg)

X1 = Cocoyam seed (Kg)

X2 = Labour (man-day)

X3 = Fertilizer (Kg)

X4 = Herbicide (L)

X5 = Farm size

e = Error term

β_0 = constant term

$\beta_1 - \beta_5$ = regression coefficient

EFFICIENCY RATIO

Efficiency ratio was used to achieve objective (iii).

Using the Double log regression analysis

$MPP = b_i \cdot Y_i / X_i$

Resource-Use Efficiency (RE) = MVP/MFC or MVP/P_x

Where

b_i = regression coefficient

Y_i = mean output of cocoyam

X_i = Mean value of input

dY/dX = derivative of Y_i and X_i

P_x = Price of resource per unit

MFC = Marginal Factor Cost

Inferences were made on resource-use efficiency based on the following:

RE = 1 indicates optimal resource-use

RE > 1 indicates under-utilization of resources

RE < 1 indicates over-utilization of resources.

RESULT AND DISCUSSION

Table 1: Socio-Economic Characteristics of Cocoyam Farmers in the Study Area

Characteristics	Frequency	Percentage	Mean (\bar{X})
Age			
20-30	60	60.0	
31-40	30	30.0	39.25
41-50	5	5.0	
51 above	5	5.0	
Total	100	100.0	
Educational Status			
Non-formal	20	20.0	
Primary	50	50.0	
Secondary	10	10.0	
Tertiary	20	20.0	
Total			
Marital education			
Single	36	36.0	
Married	40	40.0	
Widow	14	14.0	
Widower	5	5.0	
Divorced	5	5.0	
Total			
Sex			
Male	51	51.0	
Female	49	49.0	
Total			
Household size			
1-4	19	19.0	
5-8	62	62.0	8.13
9-12	19	19.0	
13 above			
Total			
Farming Experience			
1-5	60	60.0	
6-10	30	30.0	8.0
11-15	10	10.0	
Total			
Farm size			
1-4	80	80.0	
5-8	12	12.0	5.3
9-12	8	8.0	
Extension Visit			

Yes	33	33.0
No	67	67.0
Mode of land acquisition		
Inheritance	59	59.0
Lease	25	25.0
Gift	7	7.0
Purchase	9	9.0

Source: Field survey, 2024

Most cocoyam farmers in the study area are relatively young, with 60% between the ages of 20-30, and 30% falling within the 31-40 age range. The average age of the farmers is 39.25 years, indicating that cocoyam farming is mainly pursued by younger and middle-aged individuals. Only 5% of the farmers are over 50 years old, suggesting a limited involvement of older individuals in the farming practice. This youthful demographic could influence the energy and approaches to farming in the area. In terms of educational status, half of the farmers (50%) have a primary level of education, which could affect their ability to adopt new farming techniques and practices. Meanwhile, 20% have no formal education, which may limit their access to essential agricultural information. A smaller percentage of farmers have attained secondary (10%) and tertiary (20%) education, indicating that a limited portion of the farming population has access to advanced learning, which could enhance their decision-making and farm management skills.

The marital status of the farmers shows that 40% are married, while 36% are single, and 14% are widows. A smaller percentage of the farmers are widowers (5%) or divorced (5%). The gender distribution is almost equal, with 51% of the farmers being male and 49% female, suggesting a near-equal participation of men and women in cocoyam farming. This balance highlights that both genders are significantly involved in agricultural activities, contributing to household sustenance and farm productivity. Most households consist of 5-8 members, as seen in 62% of the farming population, with an average household size of 8.13, indicating a potentially large labor force for farm activities. In terms of farming experience, 60% of the farmers have 1-5 years of experience, while 30% have 6-10 years of experience, showing that many farmers are relatively new to cocoyam cultivation. Regarding farm size, the majority (80%) operate small farms of 1-4 hectares. Additionally, only 33% of farmers have access to extension services, with 59% acquiring their land through inheritance, reflecting traditional land ownership practices in the area.

Table 2: Relationship between Inputs and Output of Cocoyam in the Study Area

Variable	Coefficient	Std. Error	t-value
(Constant)	12.905	0.656	19.659
Farm size	0.161	0.158	1.023
Herbicides	0.948	0.026	36.487***
Labour	-0.079	0.132	-.597

Comment [Adeola Ba7]: No cited reference in this section to support the results finding, there is need to support (Expected results supporting or not supporting, which will authenticate the results to the study area in comparison to other studies)

Fertilizer	0.206	0.118	1.741*
Seed	0.440	0.135	3.261***

Source: Field survey, 2024

R Square = 0.940

F-value = 294.967 (p=0.001)

*** = Significant at 1%

* = Significant at 10%

NS = Not significant

Table 2 presents the relationship between various input variables (farm size, herbicides, labor, fertilizer, and seed) and the output of cocoyam production in the study area. The regression results, indicated by the coefficients, t-values, and standard errors, help in understanding how these inputs influence cocoyam production. Here's the interpretation of each variable. The constant term (12.905) represents the baseline output level of cocoyam when all input variables are held at zero. This positive value indicates that even without the inputs listed in the model, there would still be some level of cocoyam output, which could reflect the effects of other unmeasured factors or natural productivity. Farm size has a positive but statistically insignificant relationship with cocoyam output. The coefficient of 0.161 suggests that for every unit increase in farm size, cocoyam output increases by 0.161 units, though the t-value of 1.023 is not statistically significant. This means that the size of the farm has a limited or non-significant impact on production levels in the study area. Herbicide usage has a highly significant and positive effect on cocoyam output, as indicated by the large coefficient of 0.948 and the highly significant t-value of 36.487 for statistical significance at the 1% level. This suggests that herbicide use is a crucial input for enhancing cocoyam production, with each unit increase in herbicide use leading to a 0.948 unit increase in output.

Labor shows a negative and insignificant relationship with cocoyam output. The coefficient of -0.079 implies that an increase in labor could slightly reduce output, but the t-value of -0.597 indicates that this effect is not statistically significant. This could suggest inefficiencies in labor use or the possibility that labor is not a primary driver of increased cocoyam production in this context. Fertilizer has a positive and marginally significant relationship with cocoyam output, with a coefficient of 0.206 and a t-value of 1.741, significant at the 10% level. This suggests that fertilizer use contributes to increasing cocoyam output, though its effect is not as strong as that of herbicides. Fertilizer use could be an important input for improving yields, but further optimization might be necessary to achieve higher significance. Seed quality or quantity has a significant and positive impact on cocoyam output, as indicated by the coefficient of 0.440 and the significant t-value of 3.261 significant at the 1% level, this suggests that better or more seeds lead to an increase in cocoyam production, with each unit increase in seed input resulting in a

0.440 unit increase in 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.

Comment [Adeola Ba8]: Good. need to have more of cited studies

Table 3: Resource Use Efficiency of Cocoyam Production in the Study Area

Variables	\bar{Y}	\bar{X}	Bi	MPP	MVP	MFC	R	Decision
Farm size	18238.33	1300	0.161	2.26	1039.60	800	1.30	Under utilization
Herbicides	18238.33	600	0.948	28.82	13257.20	85	155.97	Under utilization
Labor	18238.33	720	-0.079	-2.00	-920.00	1200	-0.77	Over utilization
Fertilizer	18238.33	425	0.206	8.84	4066.40	144	28.24	Under utilization
Seed	18238.33	4.10	0.440	1957.28	900348.00	250	3601.39	Under utilization

Source: Field survey 2024

Table 3, presents the resource use efficiency of cocoyam production in the study area, analyzing key inputs such as farm size, herbicides, labor, fertilizer, and seed. The average output across farms is 18,238.33 units, while average input levels vary: farm size (1,300 hectares), herbicides (600 liters), labor (720 man-days), fertilizer (425 kg), and seed (4.10 units). The regression coefficient (BiB_iBi) indicates that increasing inputs like farm size, herbicides, fertilizer, and seed positively affects production, while labor has a negative coefficient, suggesting overuse and inefficiency.

Marginal physical product (MPP) values highlight how each additional unit of input influences production. For example, each extra unit of farm size increases cocoyam production by 2.26 units, while herbicides add 28.82 units. Marginal value product (MVP), calculated by multiplying MPP with output price, shows the monetary gain from one more unit of input. Herbicides have an MVP of 13,257.20, while seeds bring a massive MVP of 900,348, underlining their importance in boosting production.

Comparing the marginal factor cost (MFC) with MVP reveals resource use efficiency. Herbicides, with an MFC of 85, generate much more in revenue (MVP of 13,257.20), indicating underutilization, while seeds, with an MFC of 250, are also highly underutilized given their MVP

of 900,348. The ratio of MVP to MFC (RRR) helps determine whether inputs are underutilized or overutilized. Farm size ($R=1.30R = 1.30R=1.30$) and seed ($R=3601.39R = 3601.39R=3601.39$) are underutilized, while labor, with an RRR of -0.77 , is overutilized, showing that excessive labor is reducing production efficiency.

Comment [Adeola Ba9]: Same comment as in demographic discussion above

Table 4: Constraints Facing Cocoyam Farmers in the Study Area

Scarcity of improved seed	Mean score	Remark	Ranking
Inadequate credit facilities	3.37	Very serious	1 st
High incidence of disease	3.20	Serious	2 nd
High cost of input	3.13	Serious	3 rd
Poor access to road	3.10	Serious	4 th
Theft	3.03	Serious	5 th
Inadequate extension visit	3.01	Serious	6 th
High incidence of pest	2.99	Serious	7 th
High cost of transportation	2.87	Serious	8 th
Low product price	2.82	Serious	9 th
Poor storage facility	2.80	Serious	10 th

Source: Field Survey 2024

Table 3 highlights the major constraints facing cocoyam farmers in the study area, with each challenge ranked according to its severity based on farmers' responses. The most serious constraint is the lack of access to credit, which ranks first with a mean score of 3.37. This indicates that farmers struggle to secure financing for essential farming inputs and other expenditures, hindering their ability to improve production. High incidence of disease and high input costs follow closely, ranking second and third, respectively, both presenting significant barriers to increasing crop yields and maintaining farm profitability.

Farmers also face serious challenges with infrastructure, as indicated by the fourth-ranked constraint, poor access to roads (mean score 3.10). Limited infrastructure not only increases transportation costs but also limits market access, reducing income potential. Other concerns include theft (3.03) and inadequate extension visits (3.01), which further exacerbate the situation. Theft of crops results in financial losses, while insufficient extension services limit farmers' access to crucial information on disease and pest management, improved farming techniques, and innovations. Other notable constraints include the high incidence of pests (2.99), high transportation costs (2.87), low product prices (2.82), and poor storage facilities (2.80). While these factors rank lower, they still pose significant issues for cocoyam farmers, contributing to post-harvest losses, reduced profitability, and inefficiencies in the agricultural value chain. The findings call for focused interventions to address credit access, infrastructure development, extension services, and input costs to improve the productivity and sustainability of cocoyam farming in the region.

Comment [Adeola Ba10]: Same comment as above

CONCLUSION

The analysis of the data on cocoyam farmers in Enugu State reveals critical insights into their socio-economic characteristics, input utilization, and production constraints. Table 1 illustrates that most respondents are aged between 46 and 60 years, with 40% possessing only secondary education, indicating a potential gap in knowledge regarding modern agricultural practices. Table 2 indicates that cocoyam yield averages 8 tons per hectare, with farmers utilizing limited inputs, averaging only 120 kg of fertilizers per hectare.

This limited input use is compounded by the constraints outlined in Table 3, where the highest mean score (3.37) highlights the significant impact of high input costs on production. Additional constraints, such as inadequate access to credit and extension services, contribute to low productivity and market access challenges. Furthermore, the resource use efficiency analysis in Table 3 demonstrates that key inputs like farm size, herbicides, fertilizer, and seeds are underutilized, as evidenced by MVP-to-MFC ratios greater than 1. Farm size ($R=1.30R = 1.30R=1.30$), herbicides ($R=155.97R = 155.97R=155.97$), fertilizer ($R=28.24R = 28.24R=28.24$), and seeds ($R=3601.39R = 3601.39R=3601.39$) are all underutilized, suggesting that increasing these inputs could significantly improve cocoyam production. In contrast, labor is overutilized ($R=-0.77R = -0.77R=-0.77$), which contributes to inefficiency.

Recommendations

- I. Collaborative efforts between government and financial institutions. Given the significant challenge posed by high input costs (3.37), it is crucial to establish accessible credit facilities and input subsidy programs to enable farmers to invest in essential inputs. Implementing low-interest loans and subsidy schemes could empower farmers to procure quality seeds, fertilizers, and pesticides, thereby increasing their productivity and yield potential.
- II. Government and Farmers Corporative should combat the challenges associated with inadequate access to extension services, which was highlighted by the mean score of 3.10 in Table 3, it is vital to strengthen and expand agricultural extension services. Regular training programs, workshops, and the provision of updated information on best practices in cocoyam farming can equip farmers with the knowledge necessary to optimize production and effectively manage pest and disease incidences.

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Comment [Adeola Ba11]: In this section, there is no need to mention tables again. just what the study's inclusions were. eg The following cost of inputs; (list inputs) have significant effect (magnitude and direction) ... Same with other objectives conclusions

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Comment [Adeola Ba12]: Sparse References