



Factors Affecting Pineapple Production in Central Agricultural Zone of Cross River State, Nigeria

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Abstract: The study analyzed the factors affecting pineapple production in Central Agricultural Zone of Cross River State, Nigeria during the 2020 cropping season. The Study described the socio-economic characteristics of the farmers, determined the major productive factors that affect pineapple production, examined the gross margin per hectare and identified some major constraints in pineapple production in the area. A multistage sampling technique was used for the selection of one hundred (100) pineapple farming households. The main tool for data collection was a set of structured questionnaire. Data collected were analyzed using descriptive statistics, gross margin analysis and multiple regression analysis. The result of the socio-economic variables revealed that 69% of the respondents were females while 31% were males. Majorities (44%) were within the age bracket of 31-40 years, 53% were married with an average household size of eight persons and about 86% had formal education. The findings of the study indicated that pineapple production in the study area was profitable. The regression analysis revealed the major factors that significantly affected pineapple production in the area include farm size, labour, cost of fertilizer and cost of pineapple suckers. The major constraints of pineapple production identified by the respondents were lack of storage facilities, lack of access to credit facilities, amongst others. The study, therefore, recommends that good policies should be formulated by the government to assist farmers gain access to formal loans and grants so that they can purchase required inputs. Government should work with the private sector to improve on infrastructural facilities such as road transports and storage facilities so as to boost market linkages and reduce post-harvest losses. The findings of this study will help the pineapple farmers to know their challenges in pineapple production and advance ways of solving them so that production per hectare could be raised, thereby adding value to their farm income and raising their standard of living.

Keywords: Factors, Affecting, Pineapple and Production

1. Introduction

Agriculture is one of the major economic growth and development of developing countries including Nigeria. Nigeria's population may not be able to keep pace with food production in the near future; if its population growing rate continue to grow faster than its food production. Between 2000 and 2021, the population grew at a rate above 2.5% every year. The country's population rose from 122.3 million people (in year 2000) to an estimated 211.8 million people in the first quarter of 2021 [1]. According to the Census Bureau of the United States, the population will surpass that of the United States in 2047 to 379.25 million people; this is

worrisome. Despite the country's richness with abundant human and natural resources, favourable climatic conditions and good soils for agricultural growth [2], it is rated as the poverty capital of the world. Nigeria had the highest rate of poverty in the world with 86.9 million Nigerians living in extreme poverty in 2018 [3].

The main aim of the United Nations (UN) setting up the Sustainable Development Goals 2 (SDG 2) in 2015 was to end hunger, realize food security, improved nutrition and aid sustainable agriculture progress by 2030 [4]. The authors reported increased rate of unemployment as one of the factors fuelling the hunger conditions in Nigeria. Promoting the different agricultural sectors is one of the best ways to reduce unemployment and the global hunger index (GHI) [5].

In giving attention to the crop sector, there must be increased productivity in export crops and fruits because they offer important nutritional, economic and social values, and can contribute in reducing the GHI as well as doubling incomes of producers [5]. Pineapple is one of the export crops that need urgent attention for the improvement of its value chain in Nigeria.

It was reported that fruits production has become one of the most profitable and important businesses in the world [6]. In 2000, Thailand exported 1.1 million tonnes of fresh and processed fruits amounting to 645 million U.S Dollar [7]. It revealed that several African and Caribbean countries have risen to the challenges of fruits production as well, example, Kenya has developed horticultural exports fruits such as French beans, straw berries, avocado, pineapple and carnations; Zimbabwe has developed profitable export mangoes, strawberries, bananas, grapes, citrus and kiwi fruit. Cote d'Ivoire and Ghana export pineapples; Burkina Faso exports French beans and mangoes while Madagascar exports Litchis but Nigeria is yet to identify and produce her profitable export fruits.

Pineapple (*Ananas cosmos*), belongs to the family *Bromeliceae*. Pineapple is indigenous to South America, and has been cultivated for many centuries. It is regarded as the "queen of fruits" because of its unique aroma and sweet taste. It is only second to bananas (*Musa spp*) and oranges (*Citrus spp*) as most important harvested fruits in the world. Pineapple grows well in acidic loams, sandy loams and clay loams soils under warm and humid climate with sunny days and cool nights [8], and soil pH ranging from 4.4 to 6.5. Reproduction is through vegetative propagation using suckers and crown.

The fruit is eaten fresh, in canned form as well as in baked desserts. Pineapple is a good source minerals and vitamins and contains 15% sugar, malic and citric fruit acids [9]. Its contents make it a good raw material in confectionary industries for making sweet, fruit drinks, and household food additives [10]. Pineapple is used as ornamentals nametags which symbolize welcome, high living and opulence [11]. Pineapples have been proved to have various health benefits including anti-inflammatory, antioxidant activity and healing bowel movement. It can be used to arouse appetite, expulse internal worms, prevents ulcers, and enhances fat excretion [8].

According to Tridge, the total world production of pineapple in 2019 was 24.18 million metric tons. Costa Rica is the largest producer of pineapple, accounting for 11.8% (3.33m metric tonnes) of global output, followed by Philippines (9.75%), Brazil (8.61%), and Indonesia (7.79%). Among the pineapple producing countries of the world, Nigeria ranks 8th and 1st in Africa with 1.67 metric tonnes [12].

Despite Nigeria's position and potential in pineapple production in the world and the enormous economic advantages the country has over the crop, Nigeria's current pineapple output is only 5.93% of the world production. Esiobu et al stated that commercial value of pineapple production in Nigeria remains low when compared to other

producing nations of the world, in terms of land use for cultivation [13]. Statistics revealed that Nigeria contributed about 13.5% ha of cultivated land in pineapple production [9]. The authors reported that the size of land allocated to pineapple production in Nigeria is not commensurate with the output. In other words, Nigerian pineapple production is inadequate to meet the demand in the country and if current production, processing and marketing trends are encouraged, commercial production for export and local consumption will be enhanced.

Several studies in the past have been conducted on pineapple; Akhilomen examined the profitability and farmers' perceived constraints in pineapple production in Edo State, Nigeria. The gross margin analysis revealed that pineapple production was a profitable venture [14]. However, inadequate credit facilities, weather and disease, poor network of roads, high transportation cost, and lack of land and herbicides and poor extension services were reported to hinder pineapple production. Waziri-Ugwu and Tiku, identified that the production of pineapple in Delta state is a profitable agribusiness and would yield more output and increase the farmers income when investment is carried out in large scale. The multiple linear regression analysis showed that cost of implements did not significantly influenced pineapple output, however, farm size, cost of planting materials (suckers), cost of fertilizer and cost of labour were observed to significantly affect pineapple production [2]. Similarly, Enibe and Raphael conducted a study on pineapple production in Awgu Local Government Area of Enugu State, Nigeria using budgeting techniques, and they observed that pineapple production was profitable with the NROI value of 1.7. The authors observed that poor access road and high transportation cost were the main constraints of the pineapple producers [5].

Due to its high profitability, Edekhe et al submitted that pineapple production and distribution could be used as a panacea for food security, job creation, reduce rural-urban migration, accelerate rural development, launch the country on the part of self-sufficiency, as well as improving life and health care delivery services of the populace [15]. Food self-sufficiency could be attained if the rate of perishability of agricultural products and problems associated with it production, marketing, and distribution are minimized.

Moreover, until recently, over 70% of pineapples produced in Cross River State, Nigeria are largely cultivated by small scale farmers on fragmented farm holdings. Despite its favourable climate environments and productive resources, its production is plaque with myriads of problems. These situations need an empirical survey to investigate the factors affecting its production given that there is a market for the output for both domestic and industrial uses.

In 2006, the Dansa Company (Dangote Group of Company), invested \$45 million into pineapple production and processing in Cross River State. Since then small scale famers ventured into pineapple production across the state so as to produce the fruit to feed the Dansa Groups of Company and other companies involved in the processing of the fruits.

This implies that there is market for pineapple farmers involved in its production across the state. Central Cross River State is known to cultivate pineapple by small scale farmers in small farm holdings. The question is why has the zone not been able to cultivate pineapple on a large scale as there is demands and market for the product? It is also known that some villages within the Central Agricultural Zone of Cross River have favourable environment and climate that favours the cultivation of the crop that would have been used for increased production and enhance income, yet the crop is still being cultivated on a small scale. Given this scenario, there is need to investigate factors that affect pineapple production by small scale farmers in the area.

The main objective of this research is to determine the factors affecting small scale farmers in Pineapple production. The specific objectives were to:

1. describe the socio-economic characteristics of pineapple farmers.
2. determine major factors affecting small scale farmers in pineapple production in the study area.
3. determine gross margin among small scale pineapple farmers; and
4. identify and discuss constraints faced by pineapple farmers in the study area.

2. Methodology

The Study Area

The study was conducted in Central Agricultural Zone of

Cross River State, Nigeria. The State is one of the Niger-Delta States and shares boundaries with Benue State on the north, Ebonyi on the west, Akwa Ibom on the south west. It is bordered on the east by Cameroun Republic and fronts the Bight of Biafra on the south. Six (6) Local Government Areas (LGAs) constitutes the region namely, Yakurr, Obubra, Ikom, Etung, Abi and Boki. The land area of the region is estimated at 7666km², about 38% of the State’s total land mass (20,156 km²) and lies between Latitudes 5°45’N of the Equator and Longitude 8°30’E of the Greenwich Meridian. The region has an estimated population of about 1,016,818 [16]. The economic activities of most of the people in the region are farming complemented by traders and civil servants. Major crops produced in the region are banana, pineapple, rice, potatoes, maize, pineapples, cassava, cocoa, oil palm, and yams.

Sampling techniques

The population of this study comprised of all pineapple farmers in Central Agricultural Zone of Cross River State. Purposive sampling technique was used to select three Local Government Areas namely, Ikom, Boki and Etung. From each of the selected LGAs, and based on its reputation for pineapple production, two villages were selected. The technique of simple random sampling was then used to select 18, 15, 16, 20, 16, and 15 farmers from the list of pineapple farmers in each village respectively at 10% proportionality factor (Table 1). This gave a total of one hundred (100) pineapple farmers for this study during 2020 cropping season. This is illustrated below:

Table 1. Selection of respondents in the study area.

LGA	Villages	Estimated pineapple farmers	10% of estimated pineapple farmers
Ikom	Nde Four Corners	175	18
	Ofutop	150	15
Boki	Orumekpang	160	16
	Bashua	195	20
Etung	Bendeghe	159	16
	Agbokim Waterfalls	151	15
3	6	990	100

Source: Field data, 2020.

Method of Data Collection

Questionnaire and personal interviews were used to collect data for the study. On the other hand, secondary data were obtained from journals, internets and other relevant publications to elucidate the findings.

Analytical technique

Descriptive statistics was used to describe the socio-economic characteristics of the pineapple farmers in the area, gross margin analysis was used to determine whether pineapple farming is profitable in the area. Multiple Regression analysis was used to determine the factors that affect pineapple production in the area. The multiple regression models are stated implicitly as:

$$Y=f(X_1, X_2, X_3, X_4, X_5, X_5) + \mu$$

where:

Y=Output of Pineapples (kg)

X₁=Labour (man-days)

X₂=Farms size (hectares)

X₃=Cost of Planting materials (Pineapple Suckers in Naira (₦))

X₄=Cost of fertilizer (₦)

X₅=Capital Input (₦)

μ=error term

The estimated explicit forms are expressed thus:

$$\text{Linear: } Y=b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \mu$$

$$\text{Semi Log: } Y=\text{Log}b_0 + b_1\text{Log}X_1 + b_2\text{Log}X_2 + b_3\text{Log}X_3 + b_4\text{Log}X_4 + b_5\text{Log}X_5 + \mu$$

$$\text{Double Log: } \log Y = \log b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + \mu$$

While the Gross margin analysis was computed using the formular;

$$GM = TR - TVC$$

where:

GM=Gross Margin

TR=Total Revenue

TVC=Total Variable Cost

3. Results and Discussion

Socio-economic characteristics of the pineapple farmers

Table 2 discussed the results of the socioeconomic characteristics of the pineapple farmers in Central Agricultural Zone of Cross River State. These included sex, age, educational level, marital status and household size.

Table 2. Socioeconomic characteristics of the pineapple farmers.

Variables	Frequency	Percentage (%)	Mean
Gender			
Male	31	31	
Female	69	69	
Age			
20-30	20	20	
31-40	44	44	45
41-50	25	25	
51-60	7	7	
61 and above	4	4	
Level of education			
No education	14	14	
Primary	44	44	
Secondary school	37	37	
Tertiary	5	5	
Marital status			
Single	19	19	
Married	53	53	
Divorced	13	13	
Widow	5	5	
Widower	10	10	
Household size			
1-5	35	35	
6-10	47	47	8
11-15	18	18	

Source: compiled from field survey, 2020.

On gender, table 2 shows that majorities (69%) of the pineapple farmers in the study area were females and 31% were males. This result indicates that both men and women are involved in pineapple production in the study area but females were more involved than men. The result agrees with the notion of Esiobu, Nwosu and Onubuogu who reported that agribusiness in sub-Saharan Africa is gradually turning out to be female activities. This result, however supports the findings of Onumadu et al and Nwaiwu who documented that women are responsible for most of the arable crop production in their study area (64% and 70%) [17, 18].

The variable of age reveals that majority of the respondents were in the age range of 31 to 40 years (44%) and 41 to 50 (25%). This implies that the production of pineapple is dominated by farmers who were still active in age and are more likely to adopt new innovations for improvement in pineapple production faster than the older ones. This finding agrees with [13] who reported that majority of farmers within their active ages are more receptive to innovation, more technically efficient, effective and could withstand the stress and strain involved in pineapple production. The mean age of the farmers was 45

years and is slightly higher than the 44 years reported by [10]. The result, however disagrees with [11] reported a mean age of 54 years for pineapple farmers in Nigeria.

On educational level, the table shows that majority (44%) of the farmers had first school leaving certificate. About 42% of the pineapple farmers had certificates from secondary and tertiary schools and only 14% of the pineapple farmers had no formal education. On aggregate, approximately 86% of the pineapple farmers in the study area had trainings in formal educational institutions. The implication is that the farmers may be willingly to adopt innovative technologies for pineapple farming than the illiterate farmers, if offered to them by extension agents. The result agrees with [2, 10, 5] who reported that majorities (about 84% and 74% respectively) of the pineapple farmers had formal education in their study area.

On marital status, the study reveals that majorities (53%) of the farmers were married, 19% were single, 15% were widowed and 13% were divorced, implying that pineapple production in the area is an enterprise of married individuals which agrees with Daudu et al who reported that married household heads tended to be more involved in agriculture

than the single ones [19]. This is an indication that married farmers would be directly engaged in productive farming so as to raise enough crop produce for domestic use and for sale to meet other cash needs. This result conforms favourably to the findings of who found that majority of the pineapple farmers were married [14, 9, 5].

The variable of household size indicates that 35% of the respondents had between 1-5 people; 47% had 6-10 people per household while 18% had 11-15 people per household. The mean household size was 8 persons, indicating that pineapple farmers in the study area have a relatively large

household size. Having a larger family especially those with higher number of adult children would enable small-scale pineapple-based farmers to have enough labour to work in the farm [20]. The implication is that the pineapple farmers would be able to produce more crops at low labour cost than those with low number of household size. This result is consistent with Enibe, and Raphael who found that majority of the pineapple farmers have relatively large household size of between 6 to 10 persons in their study areas [5].

Regression Analysis

Table 3. Multiple regression analysis of the farm productive resources on pineapple production.

Variable	Linear	Semi-log	Double-log
Constant	-9.09E-13 (-0.46)	-30464.64 (8.66)*	1.331223 (-71.89)*
Labour	1.72E-20 (0.20) ^{NS}	-3572.39 (-3.08) **	0.015112 (2.48) **
Cost of fertilizer	-1.29E-16 (-0.86) ^{NS}	419.7632 (0.33) ^{NS}	-0.002949 (0.66)*
Capital input	8.21E-17 (2.93)**	618.4250 (1.14) ^{NS}	0.003542 (1.24) ^{NS}
Cost of suckers	7.53E-16 (7.32)*	4880.396 (2.35) ^{NS}	-0.023829 (2.18) **
Farm size	1.47E-13 (2.16) ^{NS}	-297.2239 (-2.72) ^{NS}	0.001658 (2.89) **
R ²	1.00	0.93	0.99
F-ratio	(1.0130)*	(188.56)*	(147391.8)*

Source: Field Survey, 2020. **=Significant at 5% level. *=Significant at 10% level. Figures in parenthesis are t-statistic values.

The ordinary Least Square (OLS) multiple regression analysis was used to determine the effect of farm productive resources in pineapple production in Central Agricultural Zone of Cross River State. Data collected on the concerned variables were fitted with three functional forms of the regression model; linear, semi-log and double-log. The independent variables were labour, farm size, cost of planting materials (suckers), cost of fertilizer and capital input. The analysis was done using the SPSS package. The outputs of the regression are as presented in Table 3. The double-log regression was chosen as the Lead Equation to discuss the variables. This was because the values in the predictor estimates indicated that those of the double log regression were the best because it indicated highest values for R-square.

The coefficient of multiple determinations R² was 0.99 indicating that about 99% of the variation in the pineapple output was accounted for the predicted variables in the area. The remaining 1% was due to random disturbance of the productive variables.

The result shows that farm size had a positive coefficient and was significant at 5%. The positive sign of the coefficient indicates that farm size positively influenced pineapple production in the area. This implies that large farm size increases output given the nature of the farming systems in the area. This conformed perfectly to the findings of [2] who reported a positive and significant relationship between farm size and output of pineapple farmers in Delta State, Nigeria.

The cost of fertilizer had a negative coefficient and was significant at 10% level of probability. This implies that increase in the cost of fertilizer will negatively affects production of pineapple. The reason could be that as cost increases, the farmers will purchase below the recommended quantities for their farms; and which would in turn reduce

output of pineapple farmers [2]. The authors also confirmed that cost of fertilizer had a negative relationship with output of pineapple and was significant.

Pineapple suckers had a negative coefficient though was significant at 5% level of probability, indicating that if cost of pineapple suckers increases, it will negatively affect the purchasing power of the farmers. The implication is that the farmers would be spending more on purchasing suckers; this will reduce the farmers income and in turn, the number of suckers to be planted.

Labour was found to positively significant to output of pineapple farmers in Central Agricultural Zone of Cross River State. This indicates that the labour influenced the output of pineapple and could be because majority of the farmers depended on family labour and hired fewer hands for the production of pineapple in the area. In other words, family labours were efficiently managed in pineapple production in the area. This result is in accordance with the findings of [10] that labour had a positive and significant relationship with output of pineapple.

Farm Capital was also found to be positive in relation to output of pineapple farmers in the study area; this suggests that if better farm tools are used to produce pineapple, more output will be harvested. This finding agrees with [21] who noted that as income of the farmers' increases, there will be urging to produce more output for increase revenue by buying better farm implements for use in the farm.

Gross Margin Analysis

Due to the fact that the sampled respondents were small-scale farmers and employed mostly crude tools and implements for farming, the fixed cost was neglected and so only the Total Variable Cost (TVC) were considered. Table 4 indicates that 50% of the total variable cost was recorded for the acquisition of pineapple suckers and hiring land for

farming. Cost of transportation recorded 22%; cost of hired labour and cost of farm implements recorded 12% and 17% respectively. The total revenue accruable from pineapple production in the study area stood at ₦20,978,000. The positive values of gross margin and Benefit Cost Ratio indicated that pineapple production was profitable in the area and would increase farmers' income when carried out in large scale. The BCR value of 2.05 implied a return of ₦2.05 for every one naira invested in the business. The result conforms to the findings of [14, 10] who reported that pineapple production is a profitable venture.

Table 4. Gross Margin Analysis in Pineapple Production from the respondents.

Variable	Amount (₦)	Percentage (%)
Variable Cost		
Cost of hired labour	1,743,740	17.01
Cost of pineapple suckers	2,544,000	24.82
Cost of transport	2,210,800	21.57
Cost of hiring land	2,533,500	24.71
Cost of farm implements	1,219,150	11.89
Total Variable Cost (TVC)	10,251,150	100
Total Revenue (TR)	20,978,000	
Gross margin (GM=TR-TVC)	10,726,850	

Source: field survey, 2020.

Constraints Associated with Pineapple Production in the Study Area

Table 5. Showing farmers constraints in pineapple production.

Variable	No. of Respondents	Percentage (%)
Pest and diseases	10	10
Storage facilities	40	40
Poor Transport Network	5	5
Limited Access to Credit	30	30
Lack of Extension Services	15	15
Total	100	100

Source: Field Survey, 2020.

Table 5 shows that the major constraints of the pineapple producers in the study area were; lack of storage facilities (40%), limited access to credit (30%), lack of extension service (15%), pest and diseases (10%) and poor transport system (5%). Lack of storage facilities have always been a major problem of perishable agricultural farm produce and accounted for the high level of wastage of pineapple in the study area. This problem was scored at 40% by the farmers and ranked first amongst others.

The inability of the respondents to access credit facilities for their pineapple business was identified as a problem by 30% of the farmers. This could be to the inability of the farmers to access credit probably due to unavailability of collateral and exorbitant interest rates charged by banks. Access to credit would change the way smallholder farmers perceive agriculture and their farming techniques [20]. It will enable the farmer to select better varieties of the crops, plant early, expand farms, as well as maintaining sustainable practices.

Lack of extension services ranked third as severe constraints (15%); farmers complained of having little or no access to extension services. This is an indication that pineapple farmers

in the study area may not be aware of modern innovation techniques available for pineapple production as well as its market trends. Farmer with more contact with extension agents are better positioned to appreciate new agricultural techniques and carry out effectively their farming than those with less or no contact [10].

Pests and diseases was reported by 10% of farmers and ranked fourth. Most farms were being attacked by pests and diseases; this drastically affected their output of pineapple in the study area. According to [22], pests and diseases rob the world of more than 40% of the attainable yield of major food crops. More so, poor road network hindered the smooth conveyance of pineapple to the market. This problem was identified as a problem by 5% of farmers. The results above is in conformity to the findings of [9, 2] who observed that poor access road for transportation, lack of access to loans, lack of storage facilities, pests and diseases and ineffective extension service, amongst others were the major constraints militating against pineapple production in their study areas. [11, 5] also documented poor road transport and lack of access to bank loans as constraints facing pineapple farmers in Enugu State, Nigeria. However, with increased agricultural funds and better road network, other constraints shown in Table 5 can be reduced.

4. Conclusion and Recommendations

This study was carried out basically to examine the factors affecting pineapple production in Central Agricultural Zone of Cross River State, Nigeria. The descriptive statistics was used to highlight the socioeconomic characteristics of pineapple producers in the study area. The result showed that 69% of the farmers were females, aged 45 years on average and were mostly married (53%) with a mean household size of 8 people. The respondents were fairly educated with 86% having some form of formal trainings in formal educational institutions. The regression analysis revealed that variables such as cost of implement, cost of land, and cost of suckers were negatively influenced with the output of pineapple produced while household size, level of education, transportation cost, farm size, number of man-days and farm income positively influenced the quantity of pineapple produced in the area. The gross margin analysis of pineapple production revealed that pineapple production was a profitable venture. In spite of the profitability of pineapple production, its production was plaque with number of problems which militates against the potentials of the industry. These problems included the lack of storage facilities, lack of access to credit facilities, poor road for transportation, pests, and diseases, and lack of extension services.

Based on the study's findings, the following recommendations were made: Farmers should be encouraged to form cooperative groups to enable them benefit from the government's programmes / extension services as well as easy access to loan. Good policies should be formulated by the government to assist farmers gain access to formal loans.

This will help the farmers to access loans for increasing their business scale.

Government should establish cold storages to reduce pineapple perishability, as well as high quality farm inputs and other farm implement at lower prices to enable the farmers gain access to them.

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