

Original article

The Impact of Socioeconomic Features and Soil Amelioration Activities on Kola nut Production in Edo and Cross River States, Nigeria

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Abstract

This study was carried out in Edo and Cross River States of Nigeria to evaluate the impacts of socio-economic features of kola nut farmers as well as soil amelioration activities on kola nut productivity in the study areas. Data were collected from 66 sampled kola nut farmers' randomly selected using multi-staged sampling technique. Data were presented and analyzed using frequency counts, percentage and linear regression. All the respondents were male showing that women are hardly involved in the actual cultivation or production of kola nut in the study areas but could be involved in the processing of the crop which is less exacting or demanding. Result shows that majority of the farmers (27.27%) are within the age bracket 51-56 years with mean age of 59.5 years, meaning that most of these farmers are still in their active productive stage of life. The farmers are fairly educated with 50% and 36.36% having primary and secondary education respectively. However, the age of farmers, membership of organization, age of farm, composting or use of kola nut pod husk and acceptance of offer of training in composting were significant factors contributing to the yield of kola nut in the study areas. It was therefore recommended that the farmers be trained on the use of kola nut pod husk for composting. They should also be encouraged to join cooperative societies through which they can access loans or other financial assistance to expand their farming business.

Keywords: Composting, Aroma, Caffeine, Tree crops.

Introduction

The term kola nut usually refers to the seeds or nuts of certain species of plant of the genus *Cola* which was formerly placed in the Cocoa family *Sterculiaceae* but now usually subsumed in the mallow family *Malvaceae*. These *Cola* species are trees native to the tropical rainforest zone of Africa.

The kola tree is an evergreen tree which is about 10-20 meters in height. It has long, ovoid leaves pointed at both ends. The leaves are large and tough with dark or green colour. The trees have cream flowers with purplish-brown striations, and star-shaped fruit. The pods are usually borne in clusters and inside each pod is about a dozen or more prismatic seeds based on the species, developed in a white seed-shell or coat. The nut's aroma is sweet and rose-like.

The first taste is bitter, but it gets milder or sweetens upon chewing. The kola nuts are usually in three colours: white, pink and red; each pod can contain any combination of the three colours (Camp & Ogunseyinde, 2024). The seed or embryo denoted as the kola nut consists of two very large fleshy cotyledons united through a tiny plantlet (Ogunlade *et*

al, 2012). There are over 40 species of kola nut, out of which, *Cola nitida* (Gbanja) and *Cola acumunata* (Abata) are the two main species grown in Nigeria. Also *Cola verticillata* and *Cola anomala* are also among the most common edible species. The most important of these four varieties is *cola nitida* because of its wide economic value (Ariyo, 2021). It is even considered to be the true Kola nut of commerce In West Africa.

Climatically, Kola trees could as well grow under the same climatic conditions as cocoa but it is less demanding in its soil requirement. However, the most suitable soil for kola nut cultivation is a well-drained fertile soil that is rich in humus (Mokwunye & Oluyole, 2017).

Importance of Kola nut

The four varieties of kola nut aforementioned have similar chemical composition and use. They contain large amounts of caffeine and smaller quantities of theobromine and kolatin. These three ingredients are alkaloids which help stimulate the nervous system and the skeletal muscles (Freeman, 2024). They also contain small amount of glucose, theophylline and

other compounds. All these are stimulants, caffeine affects the central nervous system, theobromine activates the skeletal muscles, kolatin acts on the heart, glucose provides energy to the body while theophylline is used in the treatment of asthma and to prevent sneezing and shortness of breath (Chinweike et al., 2020).

The variety *Cola nitida* has been a major commodity in West African trade for many centuries ever before its distinct taste provided the insight for numerous cola drinks. Other products derived from kola nut include kola-wine, kola-chocolate, kola pod husk-based diet as poultry feed and so on. The kola nut seeds contain caffeine's which are used as flavor in beverages through which the name cola, applied to various carbonated drinks or cola drinks such as Coca-cola, Pepsi-cola were derived. Kola is also utilized in the manufacture of some drugs in pharmaceutical industries (Adesanwo et al, 2017). This is due to the fact that the nuts possess important pharmacological properties (Ekalu, 2018).

Kola nuts also have a chemical component known as saponin. Saponin has a cleansing effect and is generally utilized as a tonic for the liver as it enhances the function of the liver and gall bladder (Mokwunye, 2009) thus kola nuts could be an important cleansing agent of the body. *Cola nitida* in particular are valued because they are noted for cleansing the mouth and providing burst of energy and are also credited with numerous medicinal and other properties. Another chemical component of kola nut is anthraquinones which has a mild laxative effect, and may also be effective in body weight control. Flavonoids which are non-toxic compound naturally found in orange and lemon peels as well as the coloring of plants are also found in kola nuts thus making kola nut a potential source of food colorant.

Kola nuts are mildly addictive which is one of the reasons why thousands of common folks enjoy chewing it at naming ceremonies, weddings and other occasions although it constituted luxury. Therefore, it is a common knowledge that kola nut is chewed by many people especially in the northern parts of Nigeria as stimulant to suppress hunger, thirst and fatigue. Kola nut is also known to give rise to excited states and also increases the capacity to endure physical exertion (Freeman, 2024). In addition, kola nut husk which is a by-product of processing the nuts is widely used for animal feeding because of its high nutritive quality. However, there was a scientific report which shows that broilers fed with kola nut husk meal have an outstanding growth performance due to the apparent nutrient utilization of the feedstuff (Adebiyi & Egbeyale, 2016).

Kola nut testa or seed coat contains high level of potassium, a macro nutrient which has however been suggested as a possible ingredient for making fertilizer (Olubamiwa et al., 2002). Kola nut pod husk (KPH) has also been utilized for the production of liquid soap as well as the production of snail feed (Mokwunye & Oluyole, 2017). According to Adeyemi & Idowu, (2016), not less than 70% of the world's annual production of kola nut currently comes from Nigeria. Also, Taiwo et al., (2017), submitted that over 200,000 tons of the nuts is produced in the country yearly.

However, in terms of trade between forest and savanna, *Cola nitida* was by far the most important variety traded and this is based on the fact that its zone of cultivation was

geographically separated from that of the other varieties. There is no appreciable difference in the methods of cultivation between *Cola nitida* and the other varieties that would account for this. The reason why *Cola nitida* is preferred above other varieties commercially could not be explained.

Kola nut production is influenced among other things by soil fertility. However, the ability of any soil to replace nutrients absorbed by crops depends mainly on the clay type, mineral composition of the fine fraction and soil fraction in toposequence. According to Oluwalana et al (2016), studies have shown that the presence of weatherable minerals in the fine sand fraction within 200cm of the profile is one of the conditions for high fertility of tropical soils.

Adebisi et al., (2015) observed that kola soils in Nigeria had low exchangeable nitrogen, phosphorus and potassium. In the same vein, widespread deficiency of boron and copper was also reported. In view of the foregoing, there is the need to artificially supply the needed nutrients in kola soil through the application of organic or inorganic fertilizer. The use of inorganic fertilizer is hindered by its scarcity, high cost, incomplete nutrient supply and possible enhancement of soil acidity in case of nitrogen fertilizers (Mokwunye & Oluyole, 2017).

It is a common knowledge that the use of animal and crop wastes in the form of farm yard manure (FYM) or compost is an acceptable practice in majority of farm communities in Nigeria. The kola nut pod husk (KPH) is an organic form of fertilizer in Nigeria with thousands of tones produced every year and is often wasted. The husk can be used in addition with other farm wastes such as animal wastes to produce organic fertilizer. This, however, can be applied to kola nut soils to augment the nutrient status of the soils. Some other factors which influence kola nut production and marketing are the socio-economic features of kola nut farmers. These include the ages of kola nut farmers, years of experience in kola nut farming, level of education, gender and so on.

Matured kola nut pods could be harvested using a sickle mounted on a long pole. After harvesting, sorting is carried out which involves removing the pods infested with weevils, diseases and other form of deformities from the healthy ones. The pods are opened while the seeds are recovered. Traditionally, the seeds are left in heaps to ferment and dry up. Alternatively, the seed coats of the nuts from these healthy pods are removed by soaking the nuts in clean water for 10 to 24 hours after which the nuts are skinned and rinsed in fresh water. The nuts are kept inside a special room where they are maintained under ambient room temperature for a period of three days to complete the curing process. The curing process involves extensive sweating to reduce the moisture content of the nuts which invariably increases the shelf life of the kola nuts. Also during this period defective or infested nuts are removed to stop the spread of the infection. Afterwards, the nuts are then graded into sizes for suitable preservation in big sized baskets (Asogwa et al., 2011).

Problem Statement

Kola nut farmers extract nutrients from the soil by harvesting kola pod every year but hardly utilize practices that help to ensure nutrient replacement such as the use of fertilizer, organic manure and so on. Adeyemi & Idowu

(2016) have reported falling kola yields as a result of old age and soil nutrient depletion. However, there is need to educate kola nut farmers to be cognizance of the conditions of the soils on their farms and to make efforts to do soil test periodically to know nutrients available in the soil and measures to employ in ensuring nutrients replacement such as the use of inorganic fertilizer, compost manure and so on. Therefore, the thrust of this research work or the main objective is to investigate the impacts of the socio economic features of the kola nut farmers as well as their concerns for soil fertility on the productivity of kola nut in the study areas.

Methodology

Sampling Techniques

This study was carried out in Edo and Cross River States of Nigeria. These two states fall within the Eastern and Southern regions of Nigeria which are rain forest zones of the country. These ecological zones have vast agricultural potentials where cash crops such as kola nut, cocoa, cashew, oil palm are mostly cultivated by small /medium farm holding farmers. Arable crops such as maize, cassava, yam, cocoyam and vegetables are also produced in abundance in these two areas. The two major types of land tenure system common in these areas are inheritance and leasehold system. Primary data were collected from kola nut farmers using multistage sampling technique which were used for the study. In Edo state, four local government areas were purposely selected out of the 18 Local Governments Areas in the state. These are Owan west, Owan east, Esan west, Umunwode. One village was chosen from each Local Government Area thus making a total of four villages chosen from the state.

The second stage involved a simple random selection of three Local Government Areas in Cross River State which are Boki, Etung and Ikom. One village was selected from each Local Government Area. The third stage involved a random selection of 30 kola nut farmers from the four villages chosen in Edo State and 36 kola nut farmers from the three villages chosen in Cross River State. Therefore, the total respondents from the two states were 66 altogether. Data collected included ages of kola nut farmers, gender, marital status, years of experience in kola nut production, farm sizes, ages of farms, land ownership system, membership of organizations, soil test, application of fertilizers/ composts, sources and types of fertilizer used, yearly kola nut production from year 2012-2015 and other relevant information.

Analytical Techniques

The analytical techniques used include descriptive statistics and simple regression analysis. Descriptive statistics was used to profile the socio-economic characteristics of the respondents. Simple regression analysis was used to capture the determinants of kola nut production

The model is given as follows:

$$Q = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + e_i$$

Where:

Q = Average quantity of kola nut production (Kg),

β s= Parameters estimated

β_0 = the constant term

X_s = the independent variables

The explanatory variables are;

X_1 = age (Years)

X_2 = educational status

X_3 = Organization

X_4 = Farm size (ha)

X_5 = Age of farm (years)

X_6 = Land ownership

X_7 = Soil test

X_8 = Fertilizer application

X_9 = Composting

X_{10} = Offer for training

e_i = error terms

Table 1 below presented the socioeconomic characteristics of the kola nut farmers. It shows that 54.55% of the respondents are from Cross River State while 45.45% are from Edo State. All the respondents are males which is an indication that men are the only gender involved in the cultivation and production of kola nut in these study areas. Women are probably involved in processing and marketing of kola nuts in the study areas. The results also shows that majority of the farmers (27.27%) are within the age bracket 51-56 years with mean age of 59.5±11.4. This means that majority of the farmers are still in their active productive stage of life with many years of experience in farming. The farmers are fairly educated with 50% and 36.36% having primary and secondary education respectively. This means that these farmers would be able to adopt modern scientific agricultural technologies which could increase their productivity.

Table 2 below shows the socioeconomic groups and on-farm data of the kola nut farmers. About 10% of the farmers revealed that they belong to one cooperative body or the other while majority declined to show their membership of any organization. The main purpose for joining cooperative organizations was for assistance. The table also revealed that 63.64% of the kola nut farmers devote between 3 to 4 hectares of their farm land for kola nut production. This shows that the kola nut farmers in the study areas operate in small/ medium scale farming. Furthermore, the table shows that about 54.55% of the farmers have had their kola plantation (age of farms) for 50 years and above. This means that the kola nut trees are fast becoming old and their productivity would tend to decline with time. Ipinmoroti *et. al.*, (2000) have reported falling kola yields as a result of old age and soil nutrient depletion. Majority of the farmers also revealed that they got their land through inheritance or by outright purchase.

Table 3 below shows the soil fertility concerns of the kola nut farmers. About 5% Of the farmers agreed that they conduct fertility test before planting, 45% answered in the negative while the remaining did not respond to the question. About 20% of the farmers revealed that they apply fertilizer especially NPK fertilizer while about 70% revealed that they do not use fertilizer on their farms. The remaining did not respond to the question while some said that fertilizers are not available or not necessary on the kola nut farm. About 5% of the farmers revealed that they obtained the fertilizers

Table 1: Socio-economic Characteristics of Respondents

Variables	Frequency	Percentage
States		
Cross Rivers	36	54.55
Edo	30	45.45
Total	66	100
Gender		
Male	66	100
Age(s) of Farmers		
Less than 45	3	4.55
45-50	12	18.18
51-56	18	27.27
57-62	9	13.64
63-68	6	9.09
69-74	12	18.18
75-80	6	9.09
Total	66	100
Marital Status		
No response	12	18.18
Married	54	81.82
Total	66	100
Educational Status		
No response	3	4.55
No formal education	3	4.55
Primary education	33	50
Secondary Education	24	36.36
Tertiary Education	3	4.55
Total	66	100

Source: Field Survey, 2021

Table 2: Socioeconomic Groups and On-farm Data

Variables	Frequency	Percentage
Organization		
No response	60	90.91
Farmers cooperatives	6	9.09
Total	66	100
Reason for Group		
No response	60	90.91
Assistance	6	9.09
Total	66	100
Farm Size (ha)		
1-2	15	22.73
3-4	42	63.64
5-6	6	9.09
7-8	3	4.55
Total	66	100
Age of Farm (years)		
No response	3	4.55
11-20	3	4.55
21-30	6	9.09
31-40	3	4.55
41-50	15	22.73
Above 50	36	54.55
Total	66	100
Nature of land ownership		
No response	9	13.64
Inherited	45	68.18
Purchased	12	18.18
Total	66	100

Source: Field Survey, 2021

from extension agents while another 5% got theirs from NGO and the others gave no answer to the question.

Also, about 82% revealed that they do use kola nut pod husk (KPH) as compost on their farms and about 41% agreed that they would engage the technology of composting if trained on it.

Table 3: Soil Fertility Concerns

Variables	Frequency	Percentage
Test soil fertility before planting		
No response	33	50
Yes	3	4.55
No	30	45.45
Total	66	100
Application of Fertilizer		
No Response	9	13.84
Yes	12	18.18
No	45	68.18
Total	66	100
Reason for not using Fertilizer		
No Response	60	90.91
Fertilizer not available	3	4.55
Fertilizer not necessary on farm	3	4.55
Total	66	100
Type of Fertilizer		
No Response	63	95.45
NPK	3	4.55
Total	66	100
Sources of Fertilizer		
No Response	60	90.91
Extension Agents	3	4.55
NGO	3	4.55
Total	66	100
Method of Fertilizer Application		
no response	60	90.91
Folia	3	4.55
Ring	3	4.55
Total	66	100
Kola pod husk used for Composting		
No Response	12	18.18
Yes	54	81.82
Total	66	100
Acceptance of offer for Training		
No Response	36	54.55
Yes	30	45.55
Total	66	100
Application of Technology if Trained on Composting		
No Response	39	59.09
Yes	27	40.91
Total	66	100

Source: Field Survey, 2021

Table 4 below shows the kola nut yield in kilogram of the 66 kola nut farmers from year 2012-2015. Majority of the kola nut farmers produce within the range of 0-50kg each per year for the four years period even with a slight decline in the peak production throughout the four years. This is further illustrated with the chart given below. The chart also shows an increase in production of kola nut from year 2012-2013 of farmers whose production fall between the range 51-100kg but dropped from 2014-2015. On the other hand, the production level of farmers whose production range above

100kg remained stable from year 2012-2014 and increased sharply in year 2015.

Table 5 below presented the result of OLS regression analysis showing the determinants of kola nut yields in the study areas. The result reveals that the regressors explained about 12% of the variation in the dependent variable which means that the coefficient of determination was 12%. However, the age of farmers, membership of organization, age of farm, composting or use of kola nut pod husk and acceptance of offer of training in composting were all positive and as well contributing to the yield of kola nut in the study areas. However, membership of organizations is not only positive but significant at 10% level of significance. On the other hand, educational status, farm size, land ownership, soil test and fertilizer application have inverse relationships with the yield of kola nut produced in the study areas.

Table 4: Kola nut Yield (kg) From Year 2012-2015

Yield (Kg)/farmer	Frequency	Percentage
0-50	48	72.72
51-100	12	18.18
101-150	3	4.55
Greater than 150	3	4.55
Total	66	100
Year 2013		
0-50	42	63.63
51-100	18	27.27
101-150	3	4.55
Greater than 150	3	4.55
Total	66	100
Year 2014		
0-50	45	68.18
51-100	15	22.73
101-150	3	4.55
Greater than 150	3	4.55
Total	66	100
Year 2015		
0-50	42	63.64
51-100	12	18.18
101-150	6	9.09
Greater than 150	6	9.09
Total	66	100

Source: Field Survey, 2021

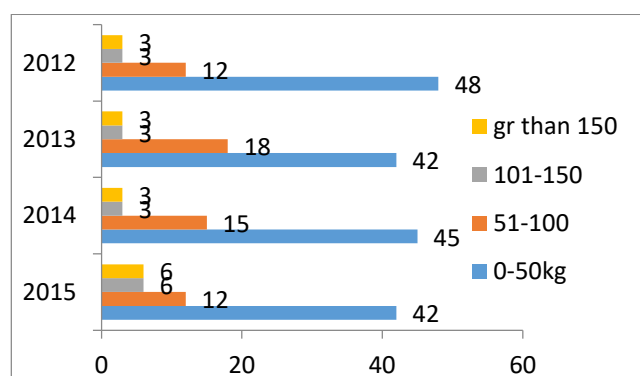


Figure 1: Kola nut Yield (kg) From Year 2012-2015

Table 5: Result of OLS Regression Analysis Showing the Determinants of Kola nut Yields

Variables	Coefficient	t-values	P>1
Constant	68.04	.283	.778
Age of farmers	924	.262	.794
Educational status	-32.16	-.597	.553
Organization	61.11***	1.700	.095
Farm size	-1.09	-.466	.657
Age of farm	13.46	.831	.410
Land ownership	-27.19	-.680	.499
Soil test	-27.84	-.845	.402
Fertilizer Application	-49.00	-.989	.327
Composting	95.40	1.17	.246
Offer of training	26.91	.428	.670
R2 = 12%			

Source: Field Survey, 2021. ***Significant at 10%

Conclusion and Recommendations

Kola nut production is a thriving business in the study areas. However, the farmers remain at low level of production and their production fluctuate from one year to the other due to some production constraints such as unavailability of fertilizers, little concerns for soil fertility, low membership of organizations such as cooperative societies, age of farmers, age of farms and so on. All these have limited production greatly in the study areas. Therefore, based on the survey results, it is recommended that the farmers should be trained on the use of kola nut pod husk for composting. The use of compost on the kola nut soils should replace inorganic fertilizers such as NPK which are not readily available or are bought at exorbitant prices by farmers. These kola nut farmers should also be given some forms of adult education since majority of them only have primary education. This would enhance their quick adoptions of new farm technologies. The kola nut farmers in these study areas should also be encouraged to join cooperative societies through which they can access loans or other financial assistance to move their farming business forward.

Conflict of Interest: We declare that there is no conflict of interest in this research article.

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