

Weevil Control and Market Potential of Kola Nut in Ogun State, Nigeria

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Abstract: Kola nuts are economic crops that play important roles in socio-economic and trade-religious life of the Nigerian people. Kola nut marketing is constrained by several factors. As a result, the study was conducted to understand the correlation among the variables affecting kola nut marketing in Ogun State, Nigeria. It was observed that the majority (96.7%) of the marketers were females; they were mostly between 40-59 years. This reflects that kola nut trading is done by older generations. The result showed that 57.1% of the respondents were secondary school leavers while 16.1% had primary education indicating that most of the respondents are literate and can adopt new technologies easily. Majority of the respondents indicated that weevils-*Balanogastriis kolae* and *Soprorhinus* sp constitute major storage pests. 98.1% respondents observed annual losses between 1-20% while 1.9% observed about 60% losses due to weevil infestation. In order to forestall pest damage, 71.4% apply insecticides containing cypermethrin which is erroneously referred to as 'gammalin 20'. It was observed that the flow of information was predominantly between kola nut marketers with no interaction with extension agents. The correlation analysis showed an inverse relationship between the percentage level of infestation and the marketers experience at 5% level of probability. This implies that years of experience improve knowledge of weevil management. The use of insecticides for kola nut preservation should be discouraged as it is hazardous to health particularly since kola nut does not undergo secondary processing before consumption. It is apparent from the foregoing, that the marketers are in dire need of extension services for dissemination of safe kola preservation practices.

Key words: Kola nut marketers • Weevils • Kola nut preservation • Insecticides • Pest infestation

INTRODUCTION

The kola tree, belonging to the family sterculiaceae is native to the tropical rainforest of Africa. About 40 *Cola* species have been described so far. The *Cola* species of economic importance in Nigeria are *Cola acuminata* (P. Beauv) Schott and Endl. and *Cola nitida* (Vent) Schott and Endl.[1]. These species are also cultivated as economic crops in the forest areas of West and Central Africa, Caribbean Islands, Mauritius, Sri Lanka and Malaysia [2]. It has been reported that kola nut was first noted in 1902 in Egba division of Ogun State, Nigeria [3]. The cultivation of *C. nitida* which replaced *C. acuminata* started in Agege and spread to the forest area following first the course of the railway line in Abeokuta, Ibadan and Offa. Eventually its cultivation extended to the present day south-south and south eastern states of

Nigeria [4]. Nigeria produces about 70% of world's kola nut with an annual estimated production of 200,000 metric tonnes of fresh nuts, mostly from south west Nigeria [5]. The south west accounts for about 88% of the produce. On the other hand, only about 10% of the produce is exported, while the rest are consumed locally [6,7,8,9,10]. Kola nut, which is primarily chewed because of its stimulants contains about 1% protein, 1.35% fats and 45% starch [6]. Its principal constituents are caffeine, theobromine, tannins, phenolics, kolatin and kolanin. The presence of alkaloids and other phytochemicals makes kola nut suitable for the manufacture of pharmaceutical products and beverages. The tannin content is also a good source of dyes in textiles and thread [11]. It also has industrial usage for the production of drugs, soft drinks, wines, candies, beverages, animal feed formulation, liquid soap and dyes [12,13]. Some Africans chew the nut for

stamina, to ease hunger, aid digestion and as an aphrodisiac. It is also believed to dispel sleep, thirst and hunger and act as an anti-depressant. It has been reported that beverage could be made by boiling powdered seed in water [14]. The nut plays an important part in the cultural, social, trade-religious life of the Nigerian people. Consequently, it is valued in Nigerian culture as a sign of friendship and peace and is consumed ("broken") at reunions, during meetings, ceremonies and festivals. Predominantly grown in the south western states of Nigeria, the nut is celebrated with awe by the Igbo tribe of the south-east Nigeria. They regard it in high esteem and as such often offered as a gift to traditional leaders and visitors. And in northern Nigeria, where the bulk of kola nut is chewed, it is greatly relished as a stimulant in substitute for alcoholic drinks. As a result, there is a heavy trade of kola from the humid southern regions to the northern arid parts of West Africa. The stem of the trees are used in the building industry, for making furniture, canoe and carvings. In Africa, the pods are used to ease labour pain.

Production Constraint-Insect Pests: While the demand is rising, the production remains low due to several limiting factors amongst which are the insect pests. The insect pests of economic importance are the weevils-*Balanogastrius kolae* and *Sophrorhinus* spp. Infestation begins on the field and continues during storage, this is capable of causing up to 100% loss if left uncontrolled in storage [15, 16]. The weevil infestation also predisposes the nuts to secondary invasion by other micro organisms, especially fungi which further lower the market value and eventually results in total destruction of the nuts. Consequently, kola nuts storage is usually laborious because the freshness of the nuts needs to be maintained for several months. It has been noted that the major problem encountered in kola nut trading business was basically that of storage with insect pest causing 53.33% kola nut losses which reduces the value and invariably the price of stored nuts [17]. It has also been reported that weevils are important pests of kola nut in Cameroon and some farmers used locally available plant materials such as dried vertiver grass roots used as repellent, dried *Eucalyptus* leaves or dried tobacco leaves spread in layers over kola nut in storage baskets [18]. Some also bury the unskinned nuts in anthills while others apply chemical insecticide such as Actellic 50EC.

Kola Nut Marketing: Kola nut has been an important trade commodity for over eight centuries in Nigeria and

other parts of Africa [19, 20]. The marketing of kola nut in Nigeria dates back to ancient times especially in the eras of the Ghana, the Shanghai, the Benin and the Kanem-Borno Empires [21]. Utilization of kola nut and its by-products for several industrial and domestic purposes contributes immensely to local and foreign exchange earnings of the country [22]. More recently, kola nuts and kola nut extracts have become increasingly popular in Europe and North America as a natural or alternative medicine. The nuts are also exported to the Middle East where they are fed to horses for strength during horse racing. This affirms that kola is an important cash crop supporting an increasing number of Nigerians who earn their living along the kola nut value chain as producers, transporters, traders, middle men and exporters. It was estimated that the internal kola nut market in Nigeria worths about one hundred and fifty thousand USD, while in 1970, kola nut export fetched USD \$157,500 to Nigerian government [23]. There is lack of information on the current volume of kola nut production in Nigeria. It was reported that Ekiti State in Nigeria generated over seventy thousand USD as revenue from kola nut production in 2010 [24]. The white and bright coloured nuts attract more premium than the red and dull colored nuts. In kola producing regions there are markets which specialize in the bulk trade of kola nuts and which target long distance wholesale traders. The long distance traders of kola nuts earn the highest profits, but this is usually controlled by merchants from the North who have access to transport and capital resources. However, most kola nut sellers in the producing areas are involved in small-scale trade. Most of the retailers/farmers sell their products in smaller units such as cups and bowls or baskets. There is no standard local price or grading for kola nut in Nigeria. Price determination and quality of nuts or grade of nuts are based on experience and mutual understanding of the buyers and sellers [25]. Kola nut marketing is done by the producers who sell at the farm gate or village site to either the wholesalers in rural and urban areas or directly to the retailers who are mostly women [26]. The farmers process the kola nuts from the pods before selling to the retailers/consumers [27]. Small holder farmers are located in remote areas with poor marketing information and market infrastructure [28]. The marketing information required by these marketers include policies which influence prices, good storage techniques, recommended insecticides during storage, marketing outlets, post-harvest handling of kola nut, etc. Availability and effectiveness of marketing infrastructures like storage

facilities, transportation facilities and communication networks determine the ability of marketing system to effectively and efficiently perform its developmental function [29]. In addition, there must be provision of adequate transportation network for effective distribution of kola nut. The existing market information, storage, transportation network, training among other factors remains unsatisfactory and does not facilitate effective distribution to the wholesalers, retailers and consumers in the major areas especially at harvesting peak periods. Information on these factors and how they correlate with each other will help in the understanding of the relationship among the variables affecting kola nut marketing in the study area. This study was designed to find out the correlation among the variables affecting the marketing for kola nut in Ogun State Nigeria, particularly with the storage pest problem, type of pest, level of infestation, information source on pesticides, mode of application, marketer's years of experience, level of education among others.

MATERIALS AND METHODS

Study Area: The study is based on Kola-nut marketers in Ogun State, Nigeria. Ogun state is in the South Western part of Nigeria. Climatically, the state falls within the rainforest belt of the country with vast agricultural potential. The state enjoys luxuriant vegetation with vast rainforest found in the south while the Northern fringe is mostly sub – savannah forest.

Data Collection and Sampling Techniques: Primary data derived from the administration of structured questionnaire using a multistage sampling technique was adopted. Three Local Government Areas namely: Ijebu North, Odogbolu and Sagamu were purposively selected. This constituted the first stage. The second stage was the simple random selection of a major kola market from each of the LGAs. In each market, twenty kola nut traders were randomly selected. The random selection of the respondents was done on a market day in the communities selected. The data collected included socio – economic variables such as age, marital status, level of education, marketing experience and type of occupation. Other data collected were knowledge of weevil, type of control option applied and quantity applied sources of information, percentage losses due to pest infestation among others.

Data Analysis: Descriptive Statistics (simple frequency tables and percentages), was used in the analysis of the socio-economic variable while spearman rho correlation analysis is used to determine the correlation between the variables affecting kola marketing in the study area.

Analytical Framework: The spearman rho correlation coefficient is given as follows

$$R_k = 1 - 6 D^2 / n(n^2 - 1)$$

Where

R_k = coefficient of correlation and it ranges from -1 to +1,
D = difference between the variables under consideration,
n = number of observations

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Kola Marketers:

Table 1 shows the age distribution of the kola nut marketers in the study area. The age of the respondents is important as it is an indication of how productive and vibrant the marketers can be. The result shows that a considerable number of marketers were between 40-59 years representing 44.6% while 14.3% of the respondents were between 20-39 years. This suggests that kola nut trading is largely in the hands of the older generation who are in the later stage of life. The study also revealed that majority were females (96.7%) while only 3.3 percent of the marketers were males. The married marketers constituted 91.2 percent while 1.8 percent was unmarried hence an indication that most of them are socially responsible. Furthermore, the result analysis shows that 57.1% of the respondents were secondary school leavers while 16.1% had primary education. This shows that most of the respondents were literate and hence have ability to comprehend and adopt innovative technologies that could enhance their livelihoods. The descriptive statistics reveals that most of the respondents (47.1%) were engaged in farming while 23.5% were involved in other forms of trading to supplement their means of livelihood.

Processing of Kola Pods: The traders informed that they usually purchased kola pods and unskinned nuts from farmers. Then the seeds are removed from the pods and soaked in water for 24h to enhance peeling off of the testa. The skinned nuts are washed and drained in basket for a few days. This is the curing process which is done to reduce the moisture content of the nuts.

Table 1: Demographic information of kola nut marketers in Ogun State

s/n	Variables	Frequency	Valid percentage
1.	AGE		
	20-39 years	8	14.3
	40-59 years	25	44.6
	60-79 years	22	39.3
	Above 79 years	1	1.8
	Total	56	100
2.	SEX		
	Male	2	3.3
	Female	58	96.7
	Total	60	100
3.	Marital Status		
	Married	52	91.2
	Single	1	1.8
	Divorced	2	3.5
	Widow	2	3.5
	Total	57	100
4.	Occupation		
	Farming	24	47.1
	Trading	12	23.5
	Civil service	9	17.6
	Private	2	3.9
	Retiree	4	7.9
	Total	51	100
5.	Educational Status		
	Primary Education	9	16.1
	Secondary education	32	57.1
	None	15	26.8
	Total	56	100

Source: Field survey 2013

Table 2: Application of insecticides on stored kola nut by the marketers in Ogun State

Variables	Frequency	Valid percentage
1.Type of pest		
<i>Balanogastriis kolae</i>	33	80.5
<i>Sorprorhinus</i> spp	8	19.5
Total	41	100
2. Level of infestation		
1-20%	52	98.1
Above 20%	1	1.9
Total	53	100
3.Type of insecticides used		
Cypermethrin	40	71.4
Aluminium phosphide pellets	14	25.0
Lime fruit	2	3.6
Total	56	100
4.Frequency of insecticide application		
Once in 2months	1	4.3
More than once in 2months	22	95.7
Total	23	100
5.Most effective insecticides		
Cypermethrin	33	55.3
Aluminium phosphide pellets	20	33.0
Both	7	11.7
Total	57	100

Source: Field survey 2013

Storage and Preservation of Nuts: Most of the marketers observed that *Balanogastriis kolae* commonly known as weevils constitute the major pest attacking stored kola nuts as shown in Table 2. All the marketers indicated that they could identify the kola weevil and its symptoms of infestation. Locally in this community, the kola nut weevil is referred to as 'kokoro obi'. 98.1% of the respondents observed annual losses between 1-20% of kola nut are due to pest infestation while only 1.9% indicated that above 60% of their kola is usually lost according to pest infestation. From the foregoing results, it is obvious that most of the marketers are knowledgeable about weevil infestation and take preventive measures to curtail losses and maximize profits.

In order to avert weevil attack during storage, the traders indicated that they would soak the kola nuts in water mixed with insecticides containing cypermethrin (active ingredient) for some minutes. The amount of insecticide to be used depends on the quantity of nuts to be treated. Normally, they rely on experience to determine the quantity of insecticide to use. The insecticides are measured using the cap of the refilled bottles. Thereafter, the nuts will be placed in baskets to allow draining and aeration before they are finally bagged and stored. Some traders indicated that they use Aluminium phosphide pellets by wrapping between a quarter pellets and one pellets in polythene or old unused piece of cloth. This is usually placed at the bottom of the basket before it is lined with banana leaves. Some of the marketers claimed that they put the wrapped Aluminium phosphide pellets in the middle of the kola nut for a week only. The method does not allow any physical contact of the chemical with the stored kola nut. After the different treatment options, the nuts are stored in black polythene bags, which are kept in baskets lined with plantain or banana leaves. In addition, the kola nuts are sorted and observed regularly for weevil attack. In case of re-infestation, the procedure is repeated until the nuts are finally sold.

Types of Insecticides Used: The result analysis in Table 2 further shows that 71.4% of the respondents use insecticides containing Cypermethrin, while 25% use Aluminium phosphide pellets to control weevil during kola nut processing. However, insecticides in liquid formulations are generally referred to as 'gammalin' by the respondents. This might be misleading as most of these marketers grew up during the gammalin revolution period and have had limited interactions with extension agents.

Table 3: Sources of information on kola nut preservation in Ogun State

Variable	Frequency	Valid percentage
Kola traders	29	51.8
Chemical retailers	26	46.4
Parents/friends/relatives	1	1.8
Total	56	100

Source: Field survey 2013

These insecticides are repackaged in refilled bottles and sold at an affordable rate. Most of the respondents (95.7%) revealed that they apply the insecticides more than once in the course of preserving kola nut. The result showed that 55% of the respondents preferred to treat kola nut with 'gammalin' as they assumed that it was more effective than Aluminium phosphide pellets. On the other hand, 33.3% of respondents preferred to apply the pellets.

The Aluminium phosphide pellet was generally referred to as 'trebor' by the marketers. With regards to quantity of pellets used, 61.7% of respondents alleged that they wrap a quarter of Aluminium phosphide pellets in polythene bag or/and in a piece of wrapper. The pellets are placed at the base of the basket containing kola nuts and this they claim can preserve the kola nut for several months.

As shown in Table 3, the sources of information on kola nut preservation available to the marketers. The result analysis shows that 51.8% receive their information on kola preservation and marketing from fellow marketers while 46.4% receive information from local pesticide vendors. From the foregoing, it can be safely presumed that these are the major sources of information available to the marketers. The local pesticide vendors would buy various brands of insecticides in retail quantities.

Table 4: The inter-correlation among socioeconomic characteristics and pest management in kola nut marketing

		Percent high level infestation	Major pest	Market experience	Information source	Education Type used	Education status	Weevil awareness
Spearman's rho	Percent high level infestation	Correlation						
		Coefficient	1.000	.594(**)	-.258(*)	-.079	-.118	-.071
		Sig. (2-tailed)	.	.000	.045	.494	.219	.747
		N	124	124	61	77	111	23
	Major pest	Correlation						
		Coefficient	.594(**)	1.000	-.132	-.154	-.178(*)	-.074
		Sig. (2-tailed)	.000	.	.306	.140	.048	.718
		N	124	144	62	93	124	26
	Market experience	Correlation						
		Coefficient	-.258(*)	-.132	1.000	-.319(*)	-.344(**)	.484(*)
		Sig. (2-tailed)	.045	.306	.	.033	.009	.031
		N	61	62	63	45	57	20
	Information source	Correlation						
		Coefficient	-.079	-.154	-.319(*)	1.000	.523(**)	-.309
		Sig. (2-tailed)	.494	.140	.033	.	.000	.133
		N	77	93	45	94	81	25
	Type used	Correlation						
		Coefficient	-.118	-.178(*)	-.344(**)	.523(**)	1.000	.
		Sig. (2-tailed)	.219	.048	.009	.000	.	.135
		N	111	124	57	81	125	25
	Education status	Correlation						
		Coefficient	-.071	-.074	.484(*)	-.309	.	1.000
		Sig. (2-tailed)	.747	.718	.031	.133	.	.
		N	23	26	20	25	25	26
	Weevil awareness	Correlation						
		Coefficient	-.044	.163	-.133	-.122	.135	.
		Sig. (2-tailed)	.632	.054	.300	.245	.139	.
		N	121	141	63	93	122	26

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Source: Field survey 2013

And subsequently repackage them in small-sized refill bottles. These were sold for as low as twenty naira (N20) only which is about 0.13USD. During the study, it was observed that women are mainly involved in this pesticide retail trade which they hawk about during market days. Consequently, the marketers receive advice and information from these local pesticide vendors. This suggests that the flow of information is predominantly between and within the kola marketers than from extension agents. There was apparently no indication that the marketers have had any contact with extension agents.

- Inter-correlation among socioeconomic characteristics and pest management in kola nut marketing

Table 4 shows the analysis of the spearman rho correlation coefficient. The result shows the impact of pest infestation and its correlates of the socioeconomic characteristics of kola marketers in the study area. Analysis as shown in Table 4 reveals that the percentage level of pest infestation has a positive correlation with the major insect pest and use of pesticide at 1% and 5% level of significance respectively. This indicates that infestation increases with high population of the weevil and in addition, the frequency of insecticide application increases with increasing level of weevil infestation. However, there is an inverse relationship between the percentage level of pest infestation and the kola marketer's experience at 5% level of significance. This is expected because as the marketers' years of experience on kola nut business increases, the more experience they acquire on weevil management during kola nut storage, hence the lower the level of pest infestation. The spearman rho correlation coefficient also revealed a positive correlation at 1% level of significance between the source of information on weevil management and the amount of pesticide applied in controlling kola pest but an inverse relationship with the marketers experience at 5% level of significance. This indicates that though information is critical in decision-making with regards to the type and amount of pesticide to be applied; nevertheless as the marketers become more experienced in the kola nut marketing business, they tend to rely more on their wealth of experience. This is in view of the fact that they would have gathered requisite knowledge and experience over the years on management of weevil on stored kola nut.

The correlation analysis also shows that educational level of the marketers has a direct correlation to the kola marketers' experience thus indicating that higher level of education is an added advantage to the experience acquired on kola marketing and storage preservation against kola nut weevil infestation. The study also revealed a positive correlation at 5% level of significance between frequency of pesticide application and the major pest (weevil). This implies that the marketers rely essentially on pesticides for weevil control.

CONCLUSIONS AND RECOMMENDATION

It was established from this study that the kola nut marketers were mainly between the ages of 40- 59 years and were by and large married females. In a similar study, it was observed that majority of kola nut farmers in Niger state were old though experienced in kola production and trading [30]. All the marketers were knowledgeable about the weevil and its symptom of infestation. The kola weevils are the most destructive pests of kola nuts in West Africa. *B. kolae* is widely distributed in Nigeria [15] and this corroborates earlier findings that some of these weevils have a wide geographical distribution [31]. It is commonly assumed that all the kola trees in Africa are weevil-infested. Some of the respondent's lose between 1-20 percent of their kola nut due to this pest infestation. This confirms another investigation that reported 100% kola nut losses as a result of weevil infestation after 3 months of storage with any form of control [15]. It also supports a previous finding that weevil constitute a major loss of kola during storage [16]. Their major source of information was from fellow traders while a few sourced their information from the pesticide retail vendors. The respondents erroneously referred to any insecticides in liquid formulations as 'Gammalin'. The major insecticides used by the traders contained active ingredients such as cypermethrin and Aluminium phosphide which are applied during kola processing. It is generally known that chemical insecticides are highly hazardous to humans and the environment. Unfortunately, these marketers do not use protective clothing to minimize exposure during application. The application of these insecticides should be discouraged as kola nut does not undergo further processing before consumption and this might pose health risk to regular consumers.

Kola is an important stimulant that provides livelihoods for an increasing number of Nigerian along the value chain. It is pertinent to note that the seasonality of

kola nut is closely linked to its market price. During the harvest season, the price will fall due to abundance of kola nuts in the markets. Therefore, storing kola nut against the period of scarcity attracts higher profit margin and this is beneficial to marketers. In the light of this, safe kola nut preservation practice is critical for the sustainability of the kola subsector. Consequently, provision of improved storage facilities will reduce losses and preserve quality kola nuts for marketing. Subsequently, this issue should be addressed adequately through the provision of extension services to these marketers.

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