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2021 Research Report

Cashew Research Programme

Technology Awareness and Adoption: A case study of Cashew Farm Rehabilitation in Kwara and Osun States, Nigeria

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Introduction

Cashew grows almost everywhere in Nigeria but it is concentrated primarily across the three southern geopolitical zones as well as the middle belt. The major producing States are Kogi, Kwara, Benue, Enugu, Abia, Anambra, Imo, Oyo and Ekiti. The National Cashew Association of Nigeria (NCAN) reported that Nigeria earned US$ 402Mn (N144.7bn) from the export of raw cashew nuts to Vietnam and other countries in 2017.

Rehabilitation as a word has been used in many different ways and contexts. It has long had a merging conceptual framework. Traditionally, the word has been used to describe a range of responses to incapability. Rehabilitation in this context is to enable moribund, unproductive cashew farms to rejuvenate for enhanced productivity. Rehabilitation techniques for cashew developed by CRIN include coppicing, complete replanting, side grafting, top grafting, phased farm replanting, fertilizer application and gapping up.

However, it has been observed that farmers are reluctant to adopt these technologies probably because of the low awareness and lack of knowledge in the economic benefits inherent in the techniques on the long run. Thus, it is expedient to assess the level of awareness and adoption of the rehabilitation techniques among cashew farmers in Nigeria.

Objectives

1. profile available rehabilitation techniques for cashew
2. assess the level of awareness of these techniques among farmers
3. estimate factors determining willingness to adopt the techniques among the farmers
4. ascertain the constraints to awareness and adoption of the techniques among the farmers in the study area

Methodology

The study was purposively conducted in Kwara State. The second stage was a purposive selection of two Local Government Areas (LGAs) in the State based on the volume of cashew production. The third stage involved a random selection of forty (40) cashew farmers in Oyun and Isin LGA of the State for questionnaire administration and group interaction. Primary and secondary data were used for the study. The total sample size was eighty (80) respondents. Well structured questionnaire was developed and administered for primary data collection while past literatures and bulletins were adopted for secondary data. Each of the cashew rehabilitation techniques (CRTs) developed by the Institute (Coppicing, Sidegrafting, Planting under matured cashew trees, Phase Replanting, Total Replanting and Gapping up of missed stands) was demonstrated to the farmers on a farm selected by the farmers in the study areas. Data was analyzed using descriptive (means, frequencies and percentages) and multinomial regression analysis.

Results and Discussion

Table 1 below shows the summary statistics of socio-economic characteristics of cashew farmers in Kwara State, Nigeria. The table reveals that the mean age of the farmers is about 55 years. The implication of this is that cashew farmers in the study area are ageing and are at the peak of their productive years and this perhaps may be responsible for the average farm size of about 9 hectares put into cultivation of the crop by farmers. Similarly, the table reveals that the maximum educational level of the farmers was tertiary education. However, a mean educational level of about 3 years shows that majority of the farmers had no formal education. The implication of this is that the farmers may perhaps not have enough and adequate access to information on improved production packages of the crop which may include but not limited to the rehabilitation techniques. This assertion corroborates the findings of Agbongiarhuoyi *et al* (2013). Furthermore, the table reveals an average household size of 3 persons. This implies that the farmers may perhaps utilize members of the household as labour for some operations relating to cultivation of the crop. However, the farmers may perhaps engage the services of hired labour. This may probably increase some transaction costs that may be incurred on the crop.

Furthermore, it was shown that the average age of the cashew farms was about 14 years. This implies that the farms are relatively new and thus the farmers may be reluctant to carry out rehabilitation techniques. Moreover, the table revealed an average farming experience of about 15 years.

Table 2 below shows the percentage distribution of cashew farmers according to levels of awareness and adoption of cashew rehabilitation techniques (CRTs) in Kwara State, Nigeria**.** The table reveals that about 52.50% of the farmers are not aware of coppicing. In addition, 60.00% and about 51.25% were not aware of side grafting and phase rehabilitation, respectively. This probably may affect the adoption level of these techniques. However, about 51.25% and 45.00%, repectively are highly aware of planting under matured cashew trees and gapping up of missed stands. This implies that these operations may have certain levels of adoption.

Furthermore, it was revealed that 71.25%, 77.50% respectively of the farmers did not adopt coppicing and sidegrafting, respectively in spite of their levels of awareness. This perhaps may be because these are operations in cashew farms that require technical knowledge and commitment which can only be achieved by farmers that have low risk aversion level. However, planting under matured cashew trees had the highest level of adoption (73.75%). This is expected based on the level of awareness described above. Also, this technique appears simple and it is a routine like operation which majority of the farmers found easy to practice.

Table 3 below shows the determinants of awareness level of rehabilitation techniques (RTs) among cashew farmers in Kwara State, Nigeria. The table reveals that age had an inverse relationship to the awareness level of coppicing. It shows that a unit decrease in age of the farmers leads to about 5% decrease in awareness level of coppicing at 10% level of probability. The implication of this is that the older a farmer is the lower the strength and ability to take risk of cutting a cashew tree. Also, the results show that a unit increase in the farmers' ability to plant under matured cashew trees leads to about 7% level of awareness at 10% level of probability. Though, the result is not in tandem with the a priori expectation as this technique is a common practice among the farmers. Similarly, the table revealed that age of cashew farms negatively determined the awareness level of total replanting. It shows that a unit decrease in the age of cashew farms leads to about 22% decrease in awareness level of total replanting at 1% level of probability. The implication of this is that as the cashew farms advance in age farmers may find it difficult to eradicate the farms to plant new cashew seedlings. This is expected as the farmers may not have any reliable source of income

pending the time new farms will mature for harvesting. Furthermore, a unit increase in the educational level of the farmers had about 6% level of awareness to coppicing at 1% level of probability. This is equally applicable to sidegrafting. A unit increase in educational level of the farmers leads to about 83% level of awareness of the technique at 1% level of probability. This implies that educated farmers have the understanding of the long term benefits of coppicing and sidegrafting techniques, respectively.

Table 4 below shows the determinants of adoption level of rehabilitation techniques (RTs) among cashew farmers in Kwara State, Nigeria. The table reveals that a unit increase in age of the farmers leads to about 7% increase in adoption level of coppicing and sidegrafting, respectively at 5% level of probability. The implication of this is that the older a farmer is the higher is the adoption level. This may probably be due to his years of experience in farming cashew. Similarly, the table revealed that age of cashew farms negatively determined the adoption level of coppicing. It shows a decrease of about 19% in adoption level at 5% level of probability. The implication of this is that as the cashew farms advance in age farmers may find it not convenient to coppice the cashew trees probably due to inherent traits noticed by the farmers in relation to the trees. This is expected as the farmers may not have any reliable source of income pending the time new farms will mature for harvesting. Furthermore, a unit increase in the educational level of the farmers had about 76% adoption level though at 10% level of probability. This implies that education has a positive relationship to coppicing as a rehabilitation technique.

Moreover, the table reveals that a unit increase in the household size of the farmers leads to about 82% adoption level of phase replanting of cashew farms and it is highly significant at 1% level of probability. The implication is that the higher the numbers of persons in the household the higher the probability of adopting phase replanting. This may mean availability of more labour to carry out the operation. However, a unit increase in farm size leads to about 14% increase in adoption level of phase replanting at 10% level of probability. Furthermore, a unit increase in quantity harvested on cashew farms leads to about 13% increase in adoption level of coppicing at 5% level of probability. The implication of this is that expected yield from coppiced cashew trees may be an incentive to the adoption level of the technique.

Table 5 below shows the percentage distribution of constraints to awareness and adoption levels of rehabilitation techniques (RTs) among cashew farmers in Kwara state, Nigeria. The table revealed that high cost of agrochemicals was very severe and ranked first among the constraints identified. It contributed about 88.00% to the constraints. However, lack of knowledge of the techniques was severe and contributed about 43.00% to the constraints.

Conclusion and Recommendations

The study assessed technology awareness and adoption of cashew farm rehabilitation in Kwara State, Nigeria. The mean age of the farmers is an indication that cashew farmers in the study area are ageing. Hence, it is recommended that efforts should be made to encourage ageing farmers to stay on the farm. This can be done by making farming attractive to both youths and adults. Moreover, more awareness campaigns should be aggressively embarked upon by the Institute to drive home the inherent benefits of adopting these techniques for rejuvenation of old farms and hence improve the productivity. This could be done by making the extension arm of the Institute more committed in advocacy and dissemination of research findings to cashew farmers and other stakeholders.

References

Agbongiarhuoyi, A.E., Uwagboe, E.O., Adebiyi, S., Ndagi, I. and Aigbekaen, E.O. 2013. Gender Involvement in Primary Coffee Beans Processing Practices in Kogi State of Nigeria. *International Journal of Applied Research and Technology*. 2(3):45-51.

2021 Research Report
Cashew Research Programme

Nursery Performance of Brazilian Biotype, Polyclonal Progenies Cashew and their Response to Natural Disease infection

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Introduction

Cashew is a perennial tree crop, in family *Anacardiaceae*. Originated from North-Eastern Brazil and introduced into West Africa in the 16th century by the Portuguese settlers (Abdul and Peter, 2010). This crop is valued mainly by its article of trade which is the nuts, been a major foreign exchange earner for many developing countries in the tropical and subtropical regions. Around 45% of the world's cashew production comes from West Africa, which comprised of Ivory Coast, Ghana, and Nigeria being major producers (Monteiro et al., 2017). However, a prime factor identified to limit the productivity of cashew have been low nut yield and nut weight. (Adu-Gyamfi, et al., 2019; Dadzie et al., 2014). This is also complicated by the new trend where nut weight is used as major criterion that determines the market value of raw cashew nuts in international trade. Low cashew productivity could be partly attributed to pest and diseases infestation, but high global demand for cashew nut from increasing world population, coupled with farmers request for varieties that provide high early yield per unit area with big nuts that can earn premium price suggest need for development of new varieties with high genetic potential for higher nut yield per unit area and improved nut quality (Gyamfi et. al., 2020). Some indigenous cashew materials have the genetic potential to compete with exotic varieties to meet the demand for yield and quality, thus indigenous Brazilian cashew biotypes were evaluated in the nursery with polyclonal seeds of Ghana origin.

Materials and Methods

The Polyclonal Seeds (PS) was of Ghana origin, obtained through PROCashew-Nigeria project. The Brazilian Large (BL) was obtained at Ochaja substation of Cocoa Research Institute of Nigeria (CRIN). Both planting materials were of the current year cashew fruiting season (2021). The moisture content of the raw cashew nuts (RCN) was determined, nut count, weight according to Lihong et al., (2014) and kernel outturn according Dieng et al., (2020). The RCN was sown in soil filled in a 20cm by 10cm polythene planting bags with one nut per bag. Routine nursery activities were carried out with cultural weeding and regular watering. Cashew seedlings were observed, data obtained on emergence, germination, height, girth, number of leaf, leaf area and branching were subjected to one – way ANOVA using SAS software package and the mean values were separated using Duncan Multiple Range Test (DMRT) at $P \leq 0.05$. Deviations/deformations in normal physiological growth of cashew parts were observed for symptoms and categorized according to Zhongrum and Masawe, (2014).

Results and Discussion

The number of RCN in 1kg PS ranges from 144 – 147 nuts while BL had nut count of 117 – 121 nut/kg. The weight of BL and PS nuts showed that both belong to size of large cashew

nut, however the weight per nut is higher in cashew BL (10.0g/nut) than 8.5g/nut recorded in PS (Table 1).

The moisture content of RCN is directly proportion to the kernel output ratio (KOR)/outturn, which is a functional of storage. Decrease in moisture of RCN results into a reduction in outturn values, good storage enhances KOR but poor storage system brings down the kernel outturn. The outturn is important to processors, while shelling percent is one of major factor considered in materials aimed for a breeding program. The RCN of BL and PS were planted at moisture of 8.0%, KOR 48.5lbs and 5.5%, KOR 47.5lbs respectively (Table 1).

Table 1: Data on Brazilian large biotype and Polyclonal seed progenies cashew

Parameter	**Polyclonal seed (PS)**	**Brazilian large (BL)**
Source of planting material	Ghana/Tanzania	Ochaja, Nigeria
Nut count (average)	145	119
Nut weight (g)	7.0 – 8.5g	6.0g – 10.0g
Moisture content (%)	5.5 – 6.7%	8.0 – 10.0%
Outturn of RCN	48 – 56lbs	48 – 54lbs
Outturn of material at planting	47.5lbs	48.5lbs
Moisture of material at planting	5.5%	8.0%
Shelling percent (%)	34%	32%

Plate 1: Polyclonal seed progenies (A) Brazilian large biotype (B)

Emergence of RCN was observed on 12th day after planting (DAP) in BL and PS, with 23.53% and 10.34% respectively. Percent germination of PS was 32.07% at 2 weeks after planting (WAP) and 88.97% at 4WAP while BL recorded 55.46% at 2WAP and 95.79% at 4WAP. The percentage increase in germination from emergence to 4WAP was 11.62% and 24.56% in PS and BL respectively. While the percent increase in germination between 2WAP and 4WAP was 36.05% (PS) and 57.89% in BL (Table 2).

Table 2: Emergence of Brazilian large biotype and Polyclonal seed progenies cashew

Parameter	**Polyclonal seed (PS)**	**Brazilian large (BL)**
Day of emergence	12DAP	12DAP
Percent emergence (%)	10.34%	23.53%
Number of foliar at germination	4 – 5 Leaves	4 – 6 leaves
Percent germination at 2WAP	32.07%	55.46%
Percent germination at 4WAP	88.97%	95.79%
Percent increase from emergence to 4WAP	11.62%	24.56%

Percent increase from 2WAP to 4WAP	36.05%	57.89%

*DAP (Day after planting), **WAP (Week after planting)

Table 3 showed the performances of BL and PS in the nursery. The height of BL was significantly higher (24.41cm) than 20.64cm recorded in PS at 4WAP. Significantly higher number of leaf and branch were also recorded in BL, while the girth and leaf area were the same in both PS and BL at 4WAP. At 6WAP, there was significant similar growth in girth, number of leaf, leaf area and branch with exception of height which was significantly higher (29.34cm) in BL compared to 25.30cm recorded in PS (Table 3).

Table 3: Performance of Brazilian large biotype and Polyclonal seed progenies cashew

Cashew material	**Height (cm)**	**Girth (mm)**	**Number of Leaf**	**Leaf area (m^2)**	**Branch**
		4 Weeks After Planting			
Polyclonal seed (PS)	$20.64^{b}\pm0.88$	$0.28^{a}\pm0.02$	$7.73^{b}\pm0.28$	$9.10^{a}\pm1.40$	$0.00^{b}\pm0.00$
Brazilian large (BL)	$24.41^{a}\pm0.83$	$0.26^{a}\pm0.02$	$9.27^{a}\pm0.58$	9.31^{a}+0.84	0.25s±0.33
		6 Weeks After Planting			
Polyclonal (PS)	$25.03^{b}\pm1.23$	$0.31^{a}\pm0.01$	$10.13^{a}\pm0.56$	44.60^{a}+3.11	$1.00^{a}\pm0.68$
Brazilian large (BL)	$29.34^{a}\pm1.06$	$0.34^{a}\pm0.01$	11.73^{a}+0.72	$44.97^{a}\pm2.85$	$2.50^{a}\pm0.55$

Natural infections with symptoms of physiological disorders common in nursery operations were assayed: wrinkled leaf, damping off, leaf spot and dieback. The seedlings recorded no incidence of damping off, however deviations from normal physiological growth were observed in varied degrees. Wrinkled leaf (Plate 2) was observed at 2WAP in 4.43% of PS and 2.67% BL, but incidence was not on the increase throughout the nursery period. Higher incidence (3.23%) of leaf spot (Plate 3) was recorded in PS to 1.78% in BL. Although dieback incidence (Plate 4) was minimal in both PS and BL, however higher (0.89%) in BL than 0.41% recorded in PS (Table 4).

Table 4: Physiological disorders in Brazilian large biotype and Polyclonal seed progenies cashew

Cashew material	**Wrinkled leaf**	**Leaf spot**	**Damping off**	**Dieback**	**Survival count (%)**
Polyclonal seed (PS)	4.43%	3.23%	0	0.41%	87.93%
Brazilian large (BL)	2.67%	1.78%	0	0.89%	95.79%

Plate 2. Wrinkled leaf: Polyclonal seed progenies (A), Brazilian large biotype (B)

Plate 3. Leaf spot: Polyclonal seed progenies (A), Brazilian large biotype (B)

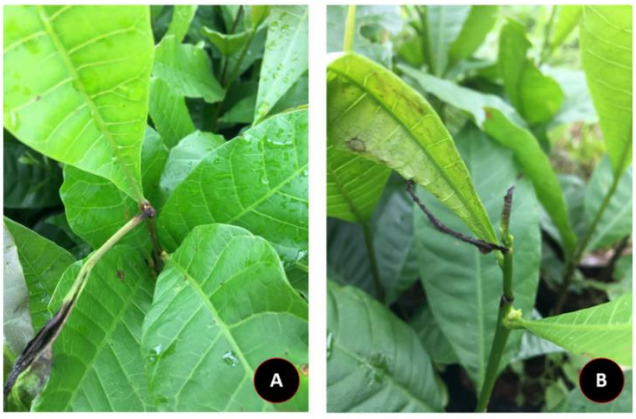

Plate 4. Seedling dieback: Polyclonal seed progenies (A) Brazilian large biotype (B)

Conclusion and Recommendation

The indigenous cashew material evaluated compared significantly with the polyclonal seeds and can be a good bases in selection for breeding especially when up to date records of yield, quality status of raw nuts and extensive genetic profiling of the materials can be obtained.

References

Abdul, S.M. and Peter, K. (2010). Cashew – A Monograph, pp: 257: New Delhi, India: Studium Press (India) Pvt. Ltd.
Adu-Gyamfi, P.K.K., Akpertey, A., Barnnor, M., Ofori, A. and Padi, F. (2020). Genotypic characterization of cashew (*Anacardium occidentale* L.) clones using agro-morphological traits. Plant-Environment Interactions. 2020; 1:196–206. https://doi.org/10.1002/pei3.10034
Adu-Gyamfi, P.K.K. (2020). Research effort to obtain marketable raw nuts and kernels. Paper presentation at 14th ACA Annual cashew conference, 9 – 11 September, 2020.
Dadzie, A.M., Adu-Gyamfi, P.K.K., Opoku, S.Y., Yeboah, J., Akpertery, A., Opoku-Ametaw, K., Assuah, M. Gyendu-Akoto, E. and Danquah, W.B. (2014). Evaluation of potential cashew clones for utilization in Ghana. Advances in Biological Chemistry, Vol. 4(4): 8p.
Dieng, F., Ngom, D., Dia, B., Sy, M.R., Ndiaye, S. and Dieye, M. (2020). Evaluation Quality Raw cashew nut (*Anacrdium occidentale* L.) nut from Major cashew producing Regions of Senegal. American journal of Agriculture and Forestry. Vol. 8(5):190-197.
Lihong, L., Masawe, P.A.L. and Jinhui, W. (2014). Data Quality Control Standard of Descriptor for Cashew. Tropical Crops Genetic Resources Institute and Naliendele Agricultural Research Institute. ISBN: 9987-446-06-X. 21-22pp.
Monteiro, F., Caturino, L., Batista, D., Indjai, B., Duarte, M.C. and Romeiras, M.M. (2017). Cashew as a high agricultural commodity in West Africa: Insights towards sustainable production in Guinea Bissau. Sustainability, 9, 1666.
Zhongrum, Z. and Masawe, P.A.L. (2014). Diseases and Insect pest of cashew in Tanzania. Tropical Crops Genetic Resources Institute and Naliendele Agricultural Research Institute. ISBN: 9987-446-09-4. 54p.

2021 Research Report

Cashew Programme

GENDER ASSESSMENT OF CASHEW FARMERS INVOLVEMENT IN CASHEW ENTERPRISES IN KOGI STATE.

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Introduction:

In the past, men were regarded as farmers while women were regarded as farmers' wives who assisted men on the farms. In recent times however, the contributions of women to agricultural productivity have started gaining attention. The role of women in agriculture is fundamental, as they are key players in the agricultural value-chain. Women form the core of the economics of sub-Saharan Africa, comprising about 60% of the informal sector and providing about 70% of total agricultural labour. Viatt, et al 2009, noted that women

constituted the mainstay of the agricultural sector, the farm labour force, the food systems and day-to-day family subsistence.

Men and women are involved in the production of different agricultural crops like cocoa, cashew, maize, kola, etc., and in animal husbandry. But that cash crops such as cocoa, kola, coffee, cashew etc. are often considered as male crops, while food crops such as cassava, maize, cowpea etc, are recognized as female crops. This was as a result of earlier colonial policies, where men's attention was directed towards cash crop production while food crop production was left to the women. In the production of cashew, men and women are generally involved in operations such as pre-planting, post-planting/processing and marketing of cocoa products. However, men are assumed to perform the harder work of land preparation (site selection, bush clearing, tree felling etc.), while women are concerned with the planting, weeding, harvesting, processing and marketing.

Objectives:

The general objective of the study assessed the gender involvement in cashew enterprises in Kogi state.

Specific objectives were to

- determine the selected personal characteristics of cashew farmers in the study areas,
- identify the constraints faced by male and female cashew farmers in the study areas and
- determine the level of involvement of male and female in cashew enterprises in the study areas.

Hypothesis of the study

$H0_1$: There is no significant difference between male and female cashew farmer involvement in cashew enterprises in the study area

Methodology

The research was conducted in Kogi state. A multistage sampling approach was used to carry out the study. Kogi state was purposively selected because it is the highest producer of cashew in Nigeria. The two highest producing Local Government Areas(LGAs) were purposively selected namely Yagba East and Ijumu. Furthermore, two villages were

randomly selected in each LGAs and 30 farmers were selected using simple random sampling selected per village. A total number of 120 respondents were interviewed for the study. The data obtained was be analysed using descriptive statistics (frequencies, means, percentages) and inferential like T-test and Chi-square.

Expected output: ascertaining different enterprise activities carried out by men and women in other to improve and encourage more female gender in cashew enterprise.

Data analysis: On going

Project Title: Analysis of Cost and Returns of Cashew Production in South-West, Nigeria

List of Investigators : **Orisasona,T.M, Ibiremo, O.S and Abdulkarim.I.F**

INTRODUCTION

The cashew tree (*Anacardium occidentale* L.), native of Brazil, was introduced to Mozambique and then to India in the sixteenth century by the Portuguese as a means of controlling coastal erosion. It is interesting to note that cashew spread within these countries with the aid of elephants that ate the bright cashew fruit along with the attached nut. The nut was too hard to digest and was later expelled with the droppings. It was not until the nineteenth century that plantations were developed and the tree then spread to a number of other countries in Africa, Asia and Latin America (Harish, 2009).

Subsequently, the tree spread to a number of countries in Africa, Asia, Latin America and West Indies. Cashew is now widely cultivated for its kernel, fruit, cashew nut shell liquid and other products. However, it is mostly found in the coastal regions of South Africa, Madagascar, Tanzania, and South Asia, from Sri Lanka to the Philippines.

. Research into the cultivation, uses and economic of cashew actually commenced in 1972, by Cocoa Research Institute of Nigeria (CRIN). Presently in Nigeria, cashew grows successfully in virtually all agro-ecological zones, including the semi-arid areas, but with a high concentration in the middle belt areas in smallholder farms and plantations. Cashew production comes from over 20 States. These include: Kogi, Kwara, Oyo, Edo,

Ondo, Anambra, Enugu, Benue, Cross River, Imo, Sokoto, Nassarawa, Ogun, Osun, Plateau and Kebbi among others (Ezeagu, 2002). The increased awareness of the economic benefits of the crop has led to astronomical increase and renewed interest in the agri-business of the crop (Hammed and Anikwe, 2008).

s. Apart from the juice of the apple that is rich in vitamin C and sugar which can be fermented to produce alcoholic drink, the cashew nut is known to contain the fat soluble vitamins A, D and K, also vitamin E to the level of 200- 2100mg/100g (Opeke, 2005).

The progressive decline in average yield of major crops is of great concern as Nigeria would be unable to feed its teeming population based on rainfed agriculture alone. Demographic growth coupled with rising income has substantially increased the demand for food in the country. Rapid increases in food production needed to feed the population will have to come from increased yield per hectare from both rainfed and irrigated agriculture. Shortfall of these will have negative effects on the production efficiency of the farmers.

Objective of the Study

The broad objective of the study is to analyse the cost and returns of cashew production in South-West, Nigeria. The specific objectives are to:

i. describe the socio-economic characteristics of the farmers in the study area,
ii. determine the cost and return structure of cashew production in the study area,
iii. determine the constraints that influence the production output levels of the cashew production in the study area.

This study is meant to assess farmers' level of efficiency by decomposing it to production efficiency. This decomposition could help to understand area(s) where corrective measures needed to be taken. In addition, the study intends to identify constraints militating against food production in the study area with a view to recommending appropriate solution. The study will also form a basis upon which crop production and improvement policies will be formulated by the government towards achieving sufficiency in food production. Empirical information that will be provided in this study could provide basis for further studies on cashew production particularly in the study area. Premised on the foregoing, the study is deemed justified.

Research Methodology

The Study Area

The study was carried out in Osun State. Two Local Government Areas (LGAs) were selected from State, using Purposive sampling techniques. The local Government Area are lwo and Ogbomosho respectively. Sixty respondents were randomly selected from each of LGA thus totaling one hundred and twenty respondents.

Sources and Methods of Data Collection

The data used for this study were mainly from the primary and secondary source. They were obtained through the well-structured questionnaire which was administered by trained enumerator,

Sampling Techniques

Multistage sampling method was employed in selecting the respondents. Sixty respondents were randomly selected from each of LGA thus totaling one hundred and twenty respondents This process gave a total of 120 of sampled cashew farmers on which the survey instruments were administered and were used for the study.

Methods of Data Analysis

Both descriptive and inferential statistics were used in analyzing the data to be collected in line with the study objectives.

Socio-economic characteristics of Cashew Farmers

Descriptive statistics such as frequency distribution tables, percentages and measures of central tendency were used to achieve objectives 1.

Cost and Return Structure of Cashew Production

Budgetary analysis was used to determine the cost and return structure of cashew farming in the study area. The model to be used is specified below. The Gross Margin technique is expressed as:

$GM = GR - TVC$ .....(1)

$NI = GM - TFC$ .....(2)

$TC = TVC + TFC$ .....(3)

Where:

GM = Gross Margin naira per tonne

NI = Net Income (naira)

GR = Gross Revenue in naira

TVC = Total Variance Cost in naira

TFC = Total Fixed Cost (naira)

TC = Total Cost (naira)

Total Variable Cost (TVC) included cost of procuring planting materials, labour cost, transport cost, e.t.c. Total Fixed Cost included depreciation on fixed inputs like cutlasses, shovel e.t.c.

Where:

NI = Net Income

TR = Total Revenue

TC = Total Cost

TFC = Total Fixed Cost

TVC = Total Variance Cost

RESULTS AND DISCUSSION

Socio-Economic Characteristic of Cashew Farmers.

The table below showed the socio-economic characteristics of cashew farmers in the study area with respect to their age, sex, household size, educational , years of experience e.t.c

Age of Respondents

The age of the respondents is an important factor that affects their level of productivity and overall coping ability within the business. Age is believed to influence the level of physical work. Table 1 showed the distribution of the respondents.

Table1: Age Distribution of Respondents

Age –Group	Frequency	Percentage
Below 30 years	6	5.0
31-40 years	14	11.7
41-50 years	36	30.0
51-60 years	38	31.7
Above 60 years	26	21.7
Total	**120**	**100.0**

Source: Field Survey, 2022

The age of the food crop farmers ranged between below 30 years and above 60 years with a mean of 58.3. Majority of the food crop farmers (31.7%) were within the age bracket of 51-60 years and this indicates that the farmers were aging. This finding is in collaboration with the result of Ekunme *et al.*, (2008) and Orewa and Izekor (2012), who stated that small scale farmers in Nigeria were aging with mean of 53 and 51 respectively.

Table 2: Distribution of respondents by household size.

Family size	Frequency	Percentage
1-3	10	8.3
4-6	54	45.0
7-9	39	32.5
10-12	12	10.0
Above 12	5	4.2
Total	**120**	**100.0**

Source: Field Survey, 2022.

According to Omolola (1988), the size of the household largely depends on the status of farmers and particularly on the number of wives the farmer has. One of the most important factors affecting production level and productivity among farmers is the composition and size of the farming family; As regards household size, majority 45.0%, had 4-6 persons per household. The average household size was 4.25 persons per household. This shows that majority of the farmers had relatively low household size which might be good economically

in terms of the households welfare as there would be less pressure on farmers' output and invariably income. This justifies Orewa and Izekor (2012).

Educational Status of Respondents

Formal education is a widely known avenue for improving knowledge and rate of skill acquisition Formal education is also important in business because it determine the degree of level of adoption of innovation and new technologies. It also determines the degree of excellences in any activity the distribution of education status of the respondents is shown in **Table Farming Experience of Respondents.**

The number of years in which the respondents have been involved in cooperative society could be used to measure their efficiency. Experience is expected to have a significant positive impact on the managerial ability of the respondents. Therefore, the more experienced they are, ceteris paribus, the more efficient he would be in management because the acquired experience over the years would be brought to bear on their activities.

Table 3: Distribution of Respondents by Farming Experience.

Experience in farming	Frequency	Percentage
Below 5 years	3	2.5
5-10 years	9	7.5
11-15 years	11	9.2
16-20 years	27	22.5
Above 20 years	70	58.3
Total	**120**	**100.0**

Source: Field Survey, 2022.

The range and mean of farming experience of the food crop farmers was between 5 and 20 years and 29.8 respectively, with majority (58.3%) having more than twenty years of experience. This conforms to Nmadu and Simpa (2014) and Musa et al., (2011), who had 89.4% and 78.4% for farming experience of than ten years respectively. The many years of

farming experience shows that the farmers are relatively experienced and there is some level of specialization and this would help in cost minimization and achieving greater efficiency.

Cashew Production Cost and Return

Table 4: Cost and Return Structure of Cashew Production

Inputs	**Mean**
Bush clearing	11835.33
Land preparation	13036.67
Weeding	13366.00
Planting	6838.00
Agro chemical application	1043.33
Harvesting	5828.00
Planting material	553.33
Fertilizer	1366.67
Insecticides	260.00
Transportation cost	17313.33
Total Variable Cost	**72819.33**
Cost of land	5000.25
Rent	2260.00
Knife	1610.67
Axe	5948.33
Cutlass	14034.00
Shovel	144.00
Boot	212.00
Total Fixed Cost	**24209.00**
Total Cost	97028.33

Total Revenue	154919.33
Gross Margin	82100.00
Net Income	**57891.00**
Profitability Index	**1.67**
Rate of Return on Investment	**67.07**

Source: Field survey, 2022

Table 4 shows the result of the gross margin analysis carried out for the study. It was showed that the mean gross margin was estimated to be ₦82, 100.00 mean net profit was estimated to be N57, 891.00 and the mean total revenue was estimated to be ₦154, 919.33 while the mean total cost was ₦97, 028.33. The mean total variable cost was estimated to be ₦72819.33 and the mean total fixed cost was estimated to be ₦24209.00.

The profitability ratios calculated to establish levels of profit in cashew production enterprise shows that the average profitability index (PI) recorded for the study area was 1.67 indicating that out of every naira earned, about ₦1.67 accrue to the cashew farers as net income.

Also, with rate of return on investment (RRI) of 67.07, an average cashew farmer therefore earns ₦67.07k profit on every naira spent on cashew production.

Constraints Encountered by Cashew Farmers in the Study Area

Constraints could be seen as hindrances or difficulties faced by farmers in production. The major constraints to the effective production of cashews in the study area are presented in Table 10. Lack of credit facility was the major constraint to cashew e production in the study area 44% as reported by the respondent. Access to agricultural credit has been positively linked to agricultural productivity in several studies (Nwaru *et al.* 2004). Yet this vital input has eluded smallholder farmers in Nigeria. Banks with

large loan funds are generally difficult to access as issues of collateral and high interest rates screen out most rural smallholders. Cooperatives, friends and family members dominate the sources of farm credit among the farmers in the study area.

Weather and Disease 35% as indicated by the farmer ranked the second most serious constraints faced by farmers in the study area. Weather condition at the time of pineapple production is very important as the crop requires humid weather to thrive and produce optimally, so adverse changes in weather affect cashew production. Lack of road and high cost of transportation (30%) was ranked as the next most severe constraint. Transportation costs were considered very high and road conditions were very poor, and these limit access to purchased inputs, credit, and output markets, and reduce the transmission of market signals. High transport costs are significant constraints to agricultural productivity, reflecting the poor state of rural transport infrastructure in the study area. About 17% of the farmers complained of the problem of low price and poor market outlet. Marketing of horticultural crops such as cashew is quite complex and risky due to the perishable nature of the fruit, post-harvest food losses; seasonality of production and bulkiness. Low output price and poor marketing among other things can be attributed to how the cashews were harvested, handled and stored. Improper handling of harvested cashews reduces the quality thereby leaving farmers at the mercy of the merchants in determining the price of the output. About 16% complained of the problem of high post harvest loss of cashews. This is because of the perishable nature of cashews which accounts for the acute post harvest losses.

About 12% complained of lack of herbicides and a further 9.7% complained of the problem of lack of land. Communal systems of land ownership prevailed among famers in the study area, in which individual ownership of land is embedded in group or kinship ownership. Communal ownership of land in Nigeria has been associated with

such problems as limited tenure security, restrictions on farmers‟ mobility and the inevitable fragmentation of land holding among rural famers. The lack of storage facility ranked second to the last of the constraints faced by 3.4% of the farmer and high cost of labour was considered the least among all the constraints faced by the pineapple farmers in the study area. This could be linked to the large family size of the farmers in the study area which constitute large percentage of family labour in cashew production in the study area.

Table 5: Constraints to cashew production in the study area

Constraints	Frequency	Percentage
Lack of credit facility	53	44
Weather and disease	42	35
Lack of road and high cost of transport	36	30
Low price and lack of market outlet	20	17

Conclusion and Recommendation

This study concluded that cashew production is profitable in the study area. The major challenge to the enterprise is Lack of credit facility, weather and disease, lack of road and high cost of transportation, low price and poor market outlet communal systems of land ownership, lack of storage facility and high cost of labour. Based on this, the study recommends that cashew nut marketers should form registered trade unions through which solution could be sought to the challenges of market price fluctuation, lack of market information as well as lack of market coordination in the study area, farmers should be provided with required credit at reasonable rate of interest. Since there is high labour requirement and higher wage rate, there is a scope to evolve labour saving technologies.

REFERENCES

Deckers J, Cundall SH, Shomari NA, Bassi G (2001): Cashew Crop Production in Tropical Africa. Romain H. Reamaekers (Ed.) Published by Directorate General for International Cooperation (DGIC), Brussels, Belgium. pp. 236-238.

Ekunwe, P. A., S. I. Orewa and C. O. Emokaro (2008).Resource-use efficiency in yam production in Delta and Kogi States, Nigeria, *Asian journal of agricultural research*, 2, 64 – 69.

Ezeagu W (2002): Assessment of the situation and Development Prospects for Cashew Nut Sector: A report on Nigerian Export Promotion Council, Abuja Nigeria (13): 1-37.

Hammed L.A, Anikwe, J.C. (2008): Cashew nuts and Production Development in Nigeria. American-Eurasian J. Sci. Res. 3(1):54– 61.

Harish Kumar, K. 2009. An Economic Analysis of Processing and Export Trade of Cashew. *M. Sc. Thesis*. University of Agricultural Sciences, GKVK, Bengaluru. Karnataka.

Nmadu, J. N.and J. O. Simpa, 2014. Rethinking the technical efficiency of small scale yam farmers in Nigeria using conventional and non-conventional inefficiency parameters, 58th Australian Agricultural and Resource Economics Society (AARES) Annual Conference, Port Macquarie, New South Wales, 4-7 February 2014.

Obiechina, C.O. 2012. Farm input use, resource misallocation and implication for Nigeria's agricultural development. In: A. O. Aniebo and COA Ugwumba (Eds.). Proceedings of International Agriculture Conference ANSUIAC 2012 on Environmental concerns and agricultural productivity: Addressing the challenges of food security, pp. 2-9.

Ojo, S .O. (2009).Improving Efficiency in food crop production for food security in Nigeria, *Agricultural journal*, Medwelljournals.2(1).

Opeke LK (2005): Tropical Commodity Tree Crops. Spectrum books Limited, Ibadan, Nigeria. (360: 371-373Orewa, S.I and O.B Izekor (2012): Technical Efficiency analysis of yam production in Edo State: A stochastic frontier Approach, *International Journal of Development and Sustainability*. 1(2), 516-526.

Simpa, J .O (2014). Technical efficiency of yam producers in Kogi State, Nigeria using conventional and non-conventional parameters, Unpublished M. Tech Thesis, Department of Agricultural Economics and Extension Technology, Federal University of Technology, Minna, Nigeria.

Structure and Use Pattern of Labour Among Cocoa farmers in Nigeria

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Introduction

Nigerian agricultural sector is dominated by small-scale farmers whose farms vary between 0.10 and 5.99 hectares in size and constitute about 80.35% of all the 29,800 million farm holdings in Nigeria (Ayanwale, 2002). Their farmers used traditional technologies called hoe-cutlass culture and their capital structure is in form of small tools and predominant usage of family labour (Oluyole et al, 2009). Human labour is about the only main source of labour available to smallholder farmers in Nigeria. Smallholder farmers contribute over 85% of domestic agricultural output in Nigeria, hence, human labour accounts for domestic food supply in Nigeria. Therefore, the needs to continue supplying food the ever-growing Nigerian population anchors on human labour productivity. In Nigerian agriculture, hired labour is predominantly used. In fact, it carries 88% of the total labour used on farms (Okuneye, 2000). Apart from hired labour, the other types of labour that could be employed are family labour and cooperative labour. The availability of labour has been found to have impact on planting precision, better weed control, timely harvesting and crop processing (Oluyole, et al, 2007). Therefore, labour is a major constraint in peasant production especially during planting, weeding and harvesting (Gocowski and Oduwole, 2003). According to Lele and Stone (1989), rapid growth in population which increases farm labour supply exerts so much pressure on land and reduces farm size per hectare. Empirical evidence has shown that available labour force comprised mostly of old people to the exclusion of young men and women within the active working age thus having a negative impact on agricultural productivity. This is because the role of youths in agricultural production cannot be over-emphasized.

With the foregoing, it could be observed that human labour plays a very significant role in agricultural development especially in the developing countries in which the level of technological development is still very low. In view of the importance of labour in agricultural production, this study was designed to investigate the structure and use pattern of farm labour in the study area.

Methodology

The project was carried out among cocoa farmers in Ondo State. Ondo East Local Government Area (LGA) was purposively selected from the State and from the LGA, Laagba community was also purposively selected because cocoa farmers are mostly concentrated in the community. Simple random sampling technique was used to collect data from a total of 144 farmers randomly selected from the community. Data were collected from the respondents with the aid of structured questionnaire and the data obtained from the questionnaire were analysed using Descriptive analysis. Descriptive Statistics was used to describe the socio-economic characteristics of the farmers as well as the structure and use of labour pattern in the study area.

Results and Discussion

The result of the socio-economic characteristics of the farmers is shown in Table 1. The table shows that 74.99% of the total respondents are above 50 years of age indicating that the proportion of old people among the respondents is very high. Meanwhile, only 25.01% of the

total respondents were 50 years and below. The lowness in the proportion of the youths is a bad pointer to cocoa production efficiency as younger farmers are more active on farm work than the aged ones. Table 1 also shows that 79.17% of the respondents were males. This is quite obvious in that farm work is a tedious work and is only men that could cope effectively with it. Apart from this, most of the farms were inherited and some traditional cultures permit only the male children to inherit farms. As regards the educational level of the respondents, the result of the analysis shows that 75.07% of the respondents were having formal education. This would improve the efficiency of the farmers in as much that literate farmers would find it easier to adopt new technologies on cocoa than the illiterate ones. The analysis on farm size shows that 66.67% of the respondents had farm size of 5 hectares andbelow which shows that most of the farmers are small scale farmers. Table 1 also shows that 50.0% of the farmers had the age of their farms greater than 30 years showing that most of the farms are old and hence the farm's productivity would reduce, therefore such farms needs to be rehabilitated. This is a good pointer to an increased productivity. Table 1 also revealed that majority (75.00%) of the farmers had purchased farms while just 12.5% inherited their farms.

Table 1: Socioeconomic Characteristics of Farmers

Variables	Frequency	Percentage
Age of farmers (years)		
≤ 30	6	4.17
31-40	6	4.17
41-50	24	16.67
51-60	48	33.33
>60	60	41.66
Total	144	100.00
Sex of farmers		
Male	114	79.17
Female	30	20.83
Total	144	100.00
Educational Status		
No formal education	36	25.00
Primary education	36	25.00
Secondary education	54	37.50

Tertiary education	18	12.50
Total	144	100.00
Marital Status		
Single	0	0.00
Married	126	87.50
Widow/widower	12	8.33
Divorced	6	4.17
Total	144	100.00
Farm size (Ha)		
≤ 5	96	66.67
6-10	30	20.83
11-15	18	12.50
Total	144	100.00
Age of farm (years)		
≤ 10	6	4.17
11-20	24	16.66
21-30	42	29.17
31-40	36	25.00
41-50	18	12.50
>50	18	12.50
Total	144	100.00
Nature of ownership		
Inherited	18	12.50
Purchased	108	75.00
Rented	12	8.33
Sharecropping	6	4.17

Total	144	100.00

Source: Field survey, 2021

Table 2 shows the structure of labour according to the different types of labour used for different activities in cocoa farming. The table shows that contract type of labour is majorly used for most activities in cocoa farming. However, cooperative labour was seldom used for any activity showing that cooperative labour is no more utilized in cocoa farming in the study area. Family labour is also utilized for all activities but at different magnitude. Activities such as land clearing, planting, weeding, application of chemicals, removal of mistotoes, harvesting of cocoa pods, conveyance of cocoa pods to the pod breaking point, breaking of cocoa pods and conveyance of cocoa beans to the point of fermentation were majorly carried out by contract labour. This is because 75.0%, 83.32%, 95.83%, 91.67%, 87.50%, 87.50%, 95.83%, 100.0% and 88.33% of the farmers respectively indicated that they utilized contract labour for such activities. However, activities such as drying of cocoa beans, parking of dried cocoa beans and preservation of cocoa beans were majorly carried out with family labour

Table 2: Distribution of labour by types of labour used for different activities in cocoa farming

Activities	**Types of Labour**					
	Family		**Contract**		**Cooperative**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
Land clearing	36	25.00	108	75.00	0	0.00
Planting	18	12.5	120	83.33	0	0.00
Weeding	6	4.17	138	95.83	0	0.00
Application of chemicals	24	16.67	132	91.67	0	0.00
Application of fertilizer	12	8.33	108	75.00	0	0.00
Removal of mistotoes	6	4.17	126	87.50	0	0.00
Harvesting of cocoa pods	30	20.83	126	87.50	0	0.00
Conveyance of cocoa pods to the point of pod breaking	24	16.67	138	95.83	0	0.00
Breaking of cocoa pods	42	29.17	144	100.00	0	0.00
Conveyance of cocoa beans to fermentation spot	42	29.17	120	88.33	0	0.00
Fermentation of cocoa beans	42	29.17	96	66.67	0	0.00
Conveyance of cocoa beans from the	38	25.00	108	75.00	0	0.00

fermentation spot to the drying spot						
Drying of cocoa beans	144	100.00	12	8.30	0	0.00
Parking of dried cocoa beans	144	100.00	6	4.17	0	0.00
Preservation of cocoa beans	144	100.00	0	0.00	0	0.00

Source: Field survey, 2021.

Table 3 shows the distribution of the labour used for cocoa farm activities based on the gender of the labour. The table shows that male labour were mostly utilized for all the activities as indicated by most respondents. On the otherhand, female labour were sparingly utilized for some activities such as land clearing, planting, application of chemicals (spraying of chemicals), removal of mistotoes and harvesting of cocoa pods as only 8.33%, 0%, 8.33%, 4.17%, 0% and 12.5% of the farmers respectively indicated that they use female labour for the respective farm activities. However, female labour were mostly used for conveyance of cocoa pods to the point of pod breaking, breaking of cocoa pods, conveyance of cocoa beans to the spot for fermentation and drying of cocoa beans.

Table 3: Distribution of labour by the gender of labour used for different activities in cocoa farming

Activities	**Gender of labour**			
	Male		**Female**	
	Freq	**%**	**Freq**	**%**
Land clearing	144	100.00	12	8.33
Planting	144	100.00	0	0.00
Weeding	126	87.50	12	8.33
Application of chemicals	126	87.50	6	4.17
Application of fertilizer	114	79.17	24	16.67
Removal of mistotoes	126	87.50	0	0.00
Harvesting of cocoa pods	114	79.17	18	12.50
Conveyance of cocoa pods to the point of pod breaking	120	83.33	126	87.50
Breaking of cocoa pods	126	87.50	132	91.67
Conveyance of cocoa beans to fermentation spot	144	100.00	138	95.83
Fermentation of cocoa beans	120	83.33	12	8.30

Conveyance of cocoa beans from the fermentation spot to the drying spot	120	83.33	132	91.67
Drying of cocoa beans	138	95.83	120	83.3
Parking of dried cocoa beans	126	87.50	30	20.83
Preservation of cocoa beans	132	91.67	24	16.67

Source: Field survey, 2021.

Conclusion

The study was carried out on the structure and use pattern of labour among cocoa farmers. The study found out that labour could be structured according to the types of labour (family labour, contract/hired labour and cooperative labour) and according to the gender of the labour. The study further revealed that contract labour is mostly used for activities such as land clearing, planting, weeding, application of chemicals, removal of mistotoes, harvesting of cocoa pods, conveyance of cocoa pods to the pod breaking point, breaking of cocoa pods and conveyance of cocoa beans to the point of fermentation while family labour is mostly used for drying of cocoa beans, parking of dried cocoa beans and preservation of cocoa beans. However, cooperative labour is no more used as a form of labour in the study area. It was found out from the study that

References

Ayanwale, B. A. (2002). Family investment in the Education of Children and Adolescents in Rural Osun State, Nigeria. In: Issues in African Rural Development Monograph Series. No. 21 Winrock International. pp. 9.

Gocowski, J. and Oduwole, S. (2003). Labour Practices in the Cocoa Sector of Southwest Nigeria with a special focus on the role of children. STCP/IITA monograph IITA, Ibadan, Nigeria.

Lele, U.R. and Stone, S. W. (1989). Population, Resource, the Environment and Agricultural Intensification: Variations on the Boserup Hypothesis. MADIA Discussion Paper No. 4, Washington D.C: The World Bank.

Oluyole, K. A., Oni, O. A., Omonona, B. T. and Adenegan, K. O. (2009). Food Security Among Cocoa Farming Households of Ondo State, Nigeria. Journal of Agricultural and Biological Science. 4 (5): 713.

Okuneye, P. A. (2000). "Employment Generating Potentials of Agricultural Processing and Storage Technology: Additional Gain in Increased Food Availability Pursuit" Paper presented at the workshop for local government officials in Lagos state.

Oluyole, K. A., Adebiyi, S. and Adejumo, M. O. (2007). An Assessment of the Adoption of Cocoa Rehabilitation Techniques Among Cocoa Farmers in Ijebu East Local Government Area of Ogun state. Journal of Agricultural Research and Policies. 2 (1): 56-60.

Cocoa Research Programme

Cocoa Pests Index Mapping: Case Study of Ondo and Osun States, South Western Nigeria

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Introduction:

Cocoa production is common to smallholder farmers in the regions of high biodiversity, which is also characterized with varieties and pests' complexes. Several factors have contributed to decline and dwindling production of cocoa in which black pod disease is key in Nigeria and Africa among many other pests. Cocoa unfortunately is threatened by many biotic and abiotic constraints resulting in significant yield losses. Among biotic constraints, diseases and insect pests are the most damaging which compromise the yield in terms of quality and quantity.

Research reports have indicated associations of many pests (virus, fungi, nematode, weed etc) with cocoa and economic implication of these pests on cocoa yield and quality varied among growing communities in Nigeria. *Phytophthora* probably causes more production losses globally than any other disease of cocoa, pathogen has several hundred recorded hosts and is of universal importance in cocoa, causing global yield losses up to 20 to 30% and tree deaths of up to 10% annually, although individual farms in wetter cocoa-growing areas may suffer total loss. However, variations and genus diversity have been recorded in many growing communities especially with the most virulent *P. megakarya* common to West Africa.

In lieu of this, the experience with pests in other producing countries demonstrate that an early action is of the utmost importance in management and limiting production losses. Unfortunately, despite the socio-economic and environmental importance of cocoa in Nigeria, data on pest index mapping are scarce to obtain. However, such country-specific data especially on cocoa will serve as pre-requisite for development of efficient management strategy and a guide for investor in cocoa production in Nigeria.

The study aim of this study is to fill this gap by compiling an inventory of pests (insects, fungi, nematodes, viruses, weeds, parasites etc) associated with cocoa production across varied ecologies.

The objective is to develop a compendium and banks of pests of concern in cocoa production in growing ecologies of Nigeria.

Materials and Methods

The survey/inventory (distribution and damage characteristics) of pests were carried out in selected cocoa farms in Ondo and Osun states (South West), Nigeria. The pests sampling was carried out between September and October 2021 in three (3) farms each in three (3) different Local Government Areas of the States.The farms were sampled by systematically traversing the plots at both diagonals and longitudinal ends. Cocoa trees were closely observed for insect species, diseases symptoms and weed association on the trees and farms. Farm data was taken which comprised of location, farm name/owner, LGA, crop, date, and plant part collected.

The intercepted insects were identified and characterized.Infected pods, leaves were collected after observation and labelled in sterile Ziploc bags and transported to laboratoryfor further studies. Samples of soils were randomly collected across the farm sites in sterile sample bags and assayed for nematode population.All the farms' sites were geo-referenced and the GPS coordinate recorded.

Cocoa samples and fungi isolates were subjected morphological (identification, photomicrographs) and molecular (DNA extraction, Electrophoresis, PCR, Sequencing) characterization at the molecular facility of UPENDO BIOINFORMATICS SERVICES, Ibadan, Nigeria.The percentages of insect pest infestation of the farms were assessed and the pest mapping of the areas were carried out using four (4) points scale as follows: 10-25% farm infested (low pest incidence), 30-50% farm infested (average spread), 55-75% farm infested (moderately spread),), 76-100% farm infested (widely spread). The nematode assay was conducted by staging the randomly collected soil samples in a sieve underlined with sterile tissue paper layered in doubles. The staging was carried out for five to seven days and nematode population collected in Eppendorf bottles were quantified using stereo microscope.

Result and Discussion

Symptoms Description of intercepted disease: The Black pod developed by an initial symptom with a small translucent spot-on cocoa pod, around 2-3 days after infection, then turns brown, eventually darkens and the spot cover the entire pod between 7 – 14 days under humid conditions. Whitish spores may be produced three to five days after the appearance of the first symptom depending on species. Black pod disease symptoms due to *P. megakarya* are however, characterized by multiple lesions which spread fast and coalesce showing abundant bloom of white zoosporangia on the lesion except for about a centimeter from the advancing margin of the lesions and varied stages of pod development may be infected (Adeniyi, 2019).

Morphological characterization of the intercepted pathogen: White, cotton-like appearance, with dense cottony mycelium. Mycelia are white and fluffy; hyphae are hyaline but multinucleate (coenocytic). Globose oogonia are spherical, with diameter of 25–33 µm). Possess sympodial sporangiophores and spherical amphigynous antheridia. Oospores are globose and aplerotic. Another isolate showed the mycelia as white and fluffy; hyphae are fairly uniform and hyaline. Globose oogonia are pyriform, 22–30 µm in diameter. Oogonium is tapered at the base to a funnel shape. Possess sympodial sporangiophores and elongated amphigynous antheridia. Oospores are globose and plerotic (fills the oogonium). Yet another isolate showed whitish grey mycelial with dense, fluffy culture. The colony was uniform, cottony to greyish brown, became dark olivaecious with dense aerial mycelium. Mature conidia was septate, colored, oval-shaped with irregular longitudinal striations.

Microscopic characterization of the intercepted pathogen and sequencing: These activities are on-going and at advance stage of completion.

The nematode assayed showed presence of species of *Melionigyne*and *Parelentycus*in large numbers and many other unidentified species at juvenile stages of growth in all the soil samples.

Developmental stage of black pod disease dependent on susceptibility of cocoa pod (Ndoumbe-Nkeng 2002), there was a link between the fruit developmental stages and pod rot

incidence and immature fruits were more susceptible (Deberdt et al. 2007). However, under field conditions, fruit susceptibility to black pod disease depend on the genetic composition of the pathogen population (Ducamp et al. 2004), the climatic conditions (Ndoumbe-Nkeng et al. 2009), and on infectious potential of the pathogen. Susceptibility of a fruit to a disease is a factor of infection efficiency; ratio of lesion density to inoculum density (Xu and Robinson 2010).

The susceptibility of cocoa fruits depended on the developmental stage but not on the position of the fruit on the tree (Takam Soh, 2013), however, Martijn ten Hoopen et al. (2012) stated that susceptibility of cocoa fruit depended on the position of the fruit on the tree, this contradiction was cleared by by the age of the trees in the study farms where increasing amounts of inoculum are deposited on the tree trunk. Susceptibility estimates showed that cherelles were more susceptible to pod rot than young and adult pods and no significant difference in susceptibility between the young pods and adult pods. *Phytophthora megakarya* is the most aggressive fungal pathogen on *Theobroma cacao* L. and poses a major threat to cocoa production in West and Central Africa. It was originally identified in Nigeria in 1979 (Brasier et al., 1981), currently *P. megakarya* is the predominant species responsible for black pod disease of cocoa in the sub region (Opoku et al., 1997, 2000). Every stage of pod development is susceptible to infection, but immature pods are the most susceptible. The first symptom observed on cocoa pods infected by *P. megakarya* is the appearance of a small translucent spot about 2 to 3 days after infection. Under humid conditions, the spot turns brown and then darkens and spreads rapidly to cover the entire pod within 7 to 14 days. Three to five days after the appearance of the first symptom, whitish spores are produced. Pod rot symptoms due to *P. megakarya* however, are characterized by multiple lesions which spread fast and coalesce with an abundant bloom of white zoosporangia on the lesion except for about a centimetre from the advancing margin. *Phytophthora megakarya* has become the main yield-limiting factor for cocoa production in affected areas (Opoku et al., 2000), the documented host range of *P. megakarya* is limited.

1. **Ondo State Pests mapping**

A: Survey of Bolorunduro LGA, Ondo

Farm 1

Village : Fagbo village

Latitude: 7’6’’13^{o}N

Longitude: 4’58’’19^{o}E

Diseases intercepted: Black pod

Pathogens intercepted: *Phytophthora* speices

Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper

Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)

Nematode population: 75

Farm 2

Village: Arugbo village

Latitude: 7’4’’34^{o}N

Longitude: 4’58’27^{o}E

Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species, *Phytophthora* species
Insects intercepted: Insects intercepted: Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*
Nematode population: 3
Farm 3
Village: Fagbo Oja
Latitude: 7'5''45^{o}N
Longitude: 4'58''3^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted: Termites, Pod husk borer & Grasshopper
Weeds intercepted: *Dryopteris*
Nematode population: 108
B: Survey of Idanre LGA, Ondo
Farm 1
Village: Aponmuoke-maye village
Latitude: 7'10''32^{o}N
Longitude: 5'2''22^{o}E
Diseases intercepted: Black pod, Cherelle wilt, Yellow okra
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted:Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*), Mistletoes
Nematode population: 34
Farm 2
Village: Owena village
Latitude: 7'11''59^{o}N
Longitude: 5'1''28^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted: Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Nematode population: 163
C:Survey of Akure South LGA, Ondo
Farm 1
Village: AponmuOlokuta
Latitude: 7'13''55^{o}N
Longitude: 5'5''0^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Nematode population: 152

Farm 2
Village: Aponmu
Latitude: 7’13’’53^{o}N
Longitude: 5’5’’0^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*
Nematode population: 289
Farm 3
Village: Aponmu Loba-Loba
Latitude: 7’4’’’41^{o}N
Longitude: 5’3’’19^{o}E
Diseases intercepted: Black pod,Cherelle wilt
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)

Table 1: Summary index of major cocoa pests in Ondo State farms

Intercepted pest	Percentage (%) pest Incidence in all farm									Average
	Ondo East LGA			Idanre LGA			Akure South LGA			
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
Diseases										
Black pod disease (*Phytophthora megakarya*)	20	54	18	22	45	20	10	22	15	25.1%
Cherelle wilt		12		45						6.3%
Yellow okra				35						
Cocoa Swollen Shoot VirusDisease (CSSVD)		+			+			+		100%
Insect pests										
Cocoa mirids (*Sahlbergellasingularis*)	3	0	0	5	0	0	7	6	5	2.9%
Cocoa stem borer (*Eulophonotusmyrmeleon*)	0	0	0	0	0	0	2	0	1	0.3%
Termites *(Macrotermesbellicosus*)	7	5	9	6	4	0	5	10	8	6%
Shield bug (Bathycoeliathalassina)	0	0	0	0	0	0	4	2	1	0.8%
Pod husk borer *(Characomastictigrapta)*	3	5	7	2	4	0	6	3	3	3.7%

Psyllid *(Mesohomotomatessamanni)*	0	3	0	0	4	0	2	0	1	1.1%
Grasshopper (*Zonocerous variegatus)*	4	2	1	5	3	0	3	1	4	2.6%
Mistletoe (*Tapinanthusbangwensis)*				35						3.8%
Mosses	5			6					6	1.8%
Dryopteris	6	16				7		4	5	4.2%
Squirrels	4	5	7	5	4	6	4	3	5	4.8%

2. Osun State Pests Mapping

A:Survey of Atakumosa West LGA, Osun

Farm 1
Village: Awori
Latitude: 7’37’’13^{o}N
Longitude: 4’41’’46^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 14

Farm 2
Village: Awori 2
Latitude: 7’21’’28^{o}N
Longitude: 4’99’’32^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)
Nematode population: 145

Farm 3
Village: Aba Odole
Latitude: 7’36’’59^{o}N
Longitude: 4’41’’37^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 164

B:Survey of Atakumosa East LGA, Osun

Farm 1
Village: TemidireIwara
Latitude: 7’30’’1^{o}N
Longitude: 4’41’’54^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 114

Farm 2
Village: Iwara 2
Latitude: 7’30’’1^{o}N
Longitude: 4’41’’54^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 54

Farm 3
Village: Olukiri Junction
Latitude: 7’30’’31^{o}N
Longitude: 4’42’’20^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Virus intercepted: chlorosis/ vein clearing on mature leaf
Nematode population: 22

C:Survey of Ayedade LGA, Osun
Farm1
Village: Agoowu 1
Latitude: 7’10’’17^{o}N
Longitude: 4’5’’50^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer, Psyllids & Grasshopper
Nematode population: 83

Farm2
Village: Agoowu 2
Latitude: 7’10’’20^{o}N

Longitude: 4’5’’57^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer, Psyllids & Grasshopper
Nematode population: 50

Table2: Summary index of major cocoa pests in Osun State farms

Intercepted pest	Percentage (%) pest Incidence in all farm									Average
	Atakunmosa West			Atakunmosa East			Ayedade LGA			
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
Diseases										
Black pod disease (*Phytophthora megakarya*)	25	40	30	15	14	10	11	25		18.8%
Cherelle wilt							25	10		3.8%
Cocoa Swollen Shoot Virus Disease (CSSVD)		+				-	-			25%
Insect pests										
Cocoa mirids (*Sahlbergellasingularis*)	13	20	10	25	15	10	40	35	0	18.7%
Cocoa stem borer (*Eulophonotusmyrmeleon*)	0	0	0	3	2	1	7	10	0	2.6%
Termites *(Macrotermesbellicosus*)	7	15	9	7	14	10	15	20	0	10.8%
Shield bug (Bathycoeliathalassina)	0	0	0	0	0	0	5	3	0	0.9%
Pod husk borer *(Characomastictigrapta)*	5	7	10	6	4	7	16	13	0	7.6%
Psyllid *(Mesohomotomatessamanni)*	2	0	3	0	2	1	4	2	0	1.6%
Grasshopper (*Zonocerous variegatus*	6	5	3	7	4	2	8	6	0	4.6%
Other pests										
Mistletoe (*Tapinanthusbangwensis)*										
Mosses	50	30	50	25	28	-	-	-	-	20.3%
Dropteris			50							5.5%
Squirrels	5	7	3	6	4	5	4	2	5	4.6%

Conclusion and Recommendations

The farmers in most of the farms visited do not know about the CRIN Elite Cocoa varieties. They simply collect pods from their neighbors' or their plots to plant.Only very few of the farmers in all locations have got any form of assistance from the Government.There is therefore the need for CRIN to embark on aggressive training/sensitization programmes for the farmers as to encourage them.The government should set up processing industries in the various states for the utilization of the readily available cocoa beans in these farms.

References

Adeniyi, D.O. (2019). Diversity of cacao pathogens and impact on yield and global production. In *Theobroma cacao* – Science for sustainability of global cocoa economy, doi: 10.5772/intechOpen. 81993. pp. 43 – 62. Published in London, United Kingdom.

Brasier, C. M., and Griffin, M. J. (1979). Taxonomy of *Phytophthora palmivora*of cocoa. Trans. Br. Mycol. Soc. 72:111-143.

Deberdt, P., Mfegue, C. V., Tondje, P. R., Bon, M. C., Ducamp, M. and Hurard, C. (2008). Impact of environmental factors, chemical fungicide and biological control on cacao pod production dynamics and Black pod disease disease (*Phytophthora megakarya*) in Cameroon. *Biological Control* 44:149-159.

Ndoumbe-Nkeng, M., Cilas, C., Nyemb, E., Nyasse, S., Bieysse, D., Flori, A., and Sache, I. (2004). Impact of removing diseased pods on cocoa Black pod disease caused by *Phytophthora* megakarya and on cocoa production in Cameroon. Crop Prot. 23:415-424.

Opoku, I.Y., Akrofi, A.Y., Appiah, A.A., 1997. The spread of *Phytophthora megakarya* on cocoa in Ghana. In: Proc. 1st Int. Cocoa Pests and Diseases Seminar, Accra, Ghana, 6 to10 November, 1995.

Opoku, I.Y., Appiah, A.A., Akrofi, A.Y., Owusu, G.K., 2000. *Phytophthora megakarya*: a potential threat to the cocoa industry in Ghana. Ghana J. Agric. Sci. 33, 237e248.

YEAR OF REPORT: 2021

PROGRAMME: COCOA

TITLE: Empirical Establishment of the Productivity of CRIN Cocoa Hybrids TC_1-TC_8 in Nigeria

Investigators: Adedeji A. R., Lawal, J. O., Famuyiwa B. S.,Taiwo O. A.,Orisasona T. M. and Ayegboyin, K. O.

INTRODUCTION

The importance of agriculture to the Nigerian economy cannot be under estimated. In Nigeria, Cocoa occupies about 0.6 million hectares and production stands at 383,000 tonnes in 2012 (FAOSTAT, 2014). The average cocoa yield in West Africa is about 0.5 tonnes/ha while for Nigeria it is around 0.4 tonnes/ha. This suggests that yield in Nigeria is low compared to the world average. Cocoa remains one of the highest foreign exchange earners among all agricultural export crops in Nigeria. After its introduction into the zone of West Africa sub- region in 1890, the area planted to cocoa increased rapidly to its present 0.7 million hectares and yield increased to peak of 310,000 tons in 1965 (Daramola, 2004) but the output declined over the years.

In 2018, Nigeria's earnings from cocoa were put at over N103 billion. The country produced about 270,000 metric tons last year, in the 2020/21 year, up from 250,000 in the 2019/20 season. And it was insinuated that this year's 2021/2022 output could fall to 250,000mt.

Some other factors responsible for the reduced cocoa output is the weather issue and late rainfall, high cost of inputs and also gradual depletion of soil fertility in cocoa growing agro-ecologies; soils with rapidly degraded properties and highly acidic due to the nature of their parent materials and leaching of the nutrients in some areas. Many other studies attributed the cocoa yield decline essentially to soil nutrients imbalance and poor planting materials (Ayanlaja, 2002 and Ojeniyi, 2010).

Problem Statement

Despite the vast hectares of land been used for cocoa farming in Nigeria, the productivity has been low. The Cocoa Research Institute of Nigeria (CRIN) introduced some new cocoa hybrids named (TC_{1-8} series) to the farmers in 2011but the empirical determination of the average number of cocoa beans per Kg, actual number of dry cocoa beans per Kg, number of pods that make one Kg of dry cocoa beans and the number of pods per tree as well as the average annual yield per hectare of cocoa hybrids TC_I to TC_8 have not been established to determine the simple but very vital information for sustainability and profitability of its production in Nigeria. To this end, it became pertinent to determine these parameters at the CRIN headquarter and at the farmers' farms. Therefore, the urgent need to critically examine the yield parameters of the new varieties of cocoa.

Specifically, this research study was based on the following objectives:

1. To determine the average number of cocoa beans in a pod;
2. To evaluate the average number of pod production per tree per year.

Methodology

The study was carried out in four different states while purposive sampling technique was used for selection of the four states namely: Ondo, Ogun, Oyo and Cross River States. In each of the states, 6 Local Government Areas (LGAs) were selected for sampling. In Ondo State, Owena, Ile-Oluji/Okeigbo, ldanre, Akure-South, Irele and Akure-North LGAs were covered and for Ogun State, Ijebu-North, Ijebu-East, Egbado-North, Egbado-South, Obafemi

Owode/Ota and Abeokuta-North were covered. In Oyo State, the LGAs covered were Oluyole, Atiba, Afijio,Ido Akinyele, and Ogo-Oluwa while for Cross River State the LGAs sampled were Ikom, Etung, Boki,Obubra,Ogoja and Akamkpa. A total of 24 LGAs were used for the study.
However, two farmers with different farms were randomly selected from the list of those that had collected the hybrid cocoa podsTC_{1-8} series from CRIN in 2011 and six trees were tagged from each farmer's farm for the purpose of this study. The respondents were asked to harvest and record the pods from all tagged trees of TC_{1-8} series to achieve the study's objectives. In all, 48 farmers' farms were sampled and 288 cocoa trees tagged for the study.

The farmers were trained on how to take data on the tagged trees while relevant data on the average beans in a pod as well as the actual number of pods per tree yield per year were collected to achieve our aims and objectives. The data collected were analyzed using descriptive statistics.

Results and Discussion

Respondents' Knowledge of Good Agricultural Practices (GAP)

Table 1 shows the respondents' knowledge of GAP. Majority (68.4%) of the farmers indicated that they have fair knowledge of GAP while only 14.9% had high knowledge. This is an indication that majority of the farmers who collected the hybrid cocoa materials did not strictly follow Good Agricultural Practices which are the basic requirements for optimum performance of the hybrid crops. Hence, this also reveals that many cocoa famers in Nigeria might not be following right production techniques and could have contributed to the current decline in the general cocoa productivity in Nigeria.

Table 1: Showing Respondents' Knowledge of GAP

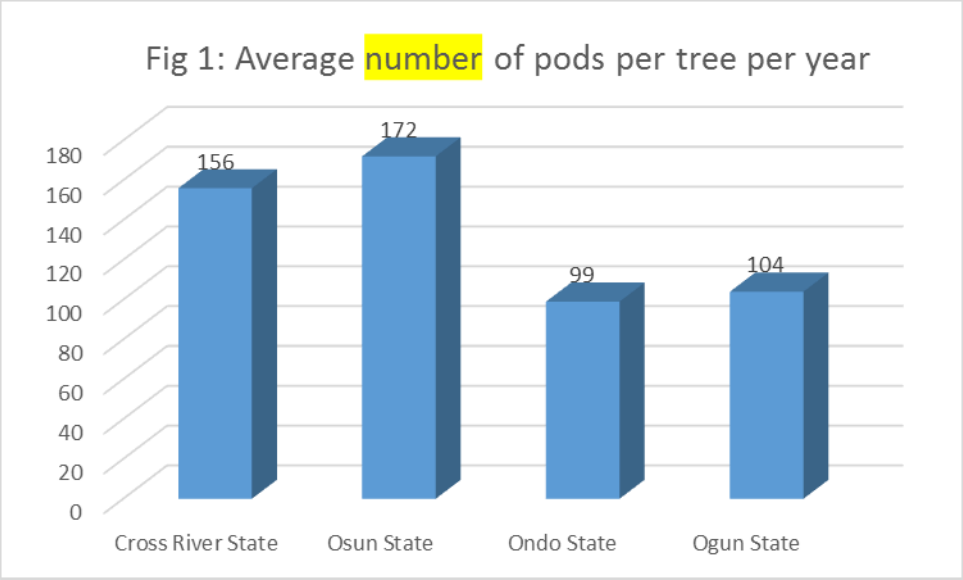
Knowledge Level	Scores	Frequency	Percentage
High Knowledge	>46.27	43	14.9
Fair Knowledge	>13.4<46.27	197	68.4
Low Knowledge	<13.4	48	16.7

Source: Field survey, 2020

Yield of pods per tree per year

Figure 1 shows average yield per tree per year per State

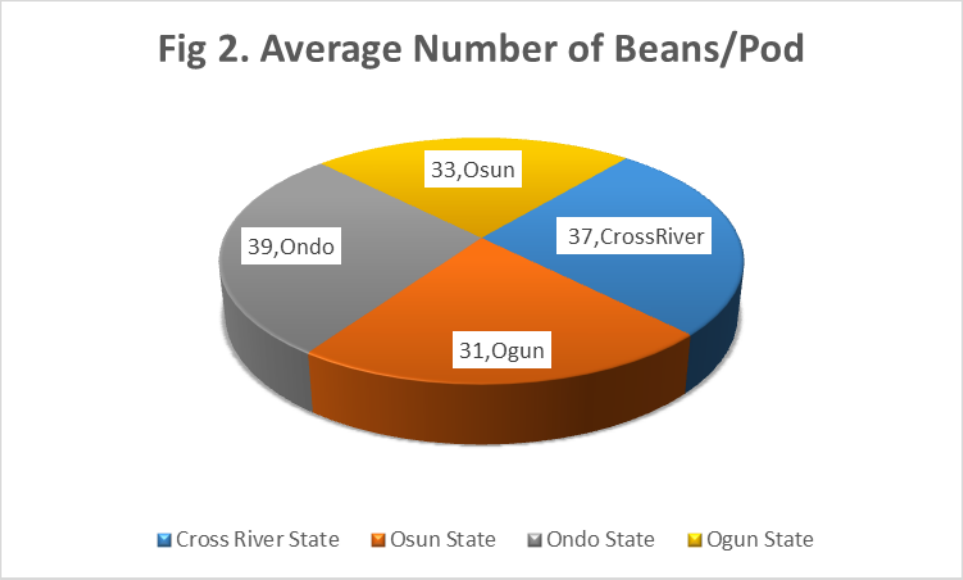
The mean yield per tree per year was 130 pods while Osun State recorded the highest yield (172) and Cross Rivers (156) pods per tree per year however, the least (99) was recorded by Ondo State. This result may be a consequence of farmers' knowledge of good agricultural practices and handling of the hybrid materials.



Source: Field survey, 2020

Average Number of Beans per Pod

Figure 2 shows the average number of beans per pod recorded from each state. The highest (39 beans/pod) was recorded in Ondo State followed by Cross River State (37 beans/pod), while the least (31beans/pod) was from Ogun State. However, the mean cocoa beans per pod from the study area was 35 beans per pod



Source: Field survey, 2020

Conclusion

Majority of the farmers had fair knowledge of Good Agricultural Practices (GAP) for optimum production of cocoa hybrid materials in Nigeria. This shows that most cocoa farmers in the country might not have the knowledge of good cocoa nursery, selection of field

with properties required for optimum cocoa production, adoption of recommended sowing methods, correct planting distances, adequate weeding and pruning of trees, control of pests and diseases, maintenance of farm hygine, proper pods harvesting as well as adequate fermentation processes of cocoa beans, yet 130 pods and 35 cocoa beans were recorded as theAverage Number of Pods per Tree per Year and Average Number of Beans per Cocoa Pod respectively on Farmer's Farms. This result is consistent with the qualities exhibited by TC_{1-8}cocoa assertions at the experimental field of Cocoa Resaerch Institute of Ibadan in 2011. However, the average productivity of both the farmers and their planting materials will increase with adequate training of these cocoa farmers on GAP.

Recommendation

More awareness and training on the management of the CRIN hybrids should be made available to the farmers, while the hybrid materials should also be available to the farmers to improve their yield and consequently increase their livelihood.

REFERENCES

Adegeye, A. (2003): Achieving a Revolution in Cocoa Production in Cocoa production in Ondo State. A paper presented at a seminar on cocoa, organized by the FUTA Venture held in FUTA Ondo State 13 – 14 October, 2003.

Daramola, A.G (2004): Competitiveness of Agriculture in a Global Economy: Any Dividend(s) of Democracy?'' Inaugural lecture Series 36, delivered Federal University of Technology, Akure, 14-15.

CRIN TC1-8 (2011). Tc1-8 Cocoa hybrid, Characteristics and Qualities

2021 Research Report
Cocoa Research Program

Diagnostic Survey of Organic Cocoa Production in Nigeria and Selection of Conventional Cocoa plantations for Conversion to Organic

Ogunlade M.O., Adedeji A.R. Oyedokun V.A., Adejobi K.B, Oluyole K.A, Famuyiwa B. and Olasupo Festus

Introduction

Consumers' consciousness about the safety of what they consume and the increased awareness of the need for safety of the environment has brought organic cocoa production into the limelight. Organic cocoa is a bit more acidic and bitter (astringent) than normal cocoa. Organic cocoa is (mainly) used by premium chocolate brands to make chocolates. It is also used in personal care products as organic cocoa contains nutrients such as minerals, vitamins, antioxidants and other essential analogues which are beneficial for maintaining a healthy skin. Demand for premium chocolate brand by consumers is increasing which is in turn escalating the demand for organic cocoa

Consumers are fond of chocolates but they are also conscious about their health which allows these chocolate brands to manufacture chocolate using organic cocoa. Consumers are demanding for natural chocolates without the use of any chemicals and artificial ingredients. Due to this, there is an increasing growth of organic cocoa market.

Nigeria has great potential for exploiting organic cocoa market as there is large market demand for organic cocoa in developed countries especially in Europe and America.

This study aimed at

a. determining the status of organic cocoa production in Nigeria
b. producing organic cocoa by:

i. Converting cocoa plantation from conventional to organic farming
ii. New establishment of organic cocoa while ensuring compliance with requirements of organic certification with a view to extend the technology to Nigerian cocoa farmers.
iii. Improving the income and sustainable livelihood of an average cocoa farmer in Nigeria

Methodology

Diagnostic survey

The survey was conducted in three Southern States in Nigeria. The States were Ondo, Oyo and Cross River States. In each of the States, three cocoa producing cocoa producing local government areas (LGAs) were purposively selected for the study. In each of the chosen LGAs, one community was selected thus making a total of nine communities chosen for the study. A total of 172 respondents were randomly selected for the study. Information was collected from the respondents with the use of structured questionnaire. The data retrieved from the information collected were analysed using descriptive statistics.

Selection of conventional cocoa plantations for conversion to organic cocoa farm

One cocoa plantation at CRIN Headquarters located at Zone 9 with Latitude 7.21348833 and longitude 3.854928 was selected. Ten core soil samples were collected randomly from the

selected plot at two depths of 0-20cm and 20 - 40cm. The core samples were bulked into two composite samples for each of the depth. In Owena, a cocoa plantation located within latitude 7.201258333 and longitude 5.026525 was selected. Ten core soil samples were also collected randomly at two depths and bulked int two composite samples.
The soil samples were air dried under room temperature, sieved through 2mm sieve and sent to the laboratory for routine analysis using standard laboratory methods.

Results and Discussion
Table 1 shows the socioeconomic characteristics of the respondents. The Table shows that majority (80.2%) of the respondents were males while 46.5% of the respondents were above 50 years of age. The Table also shows that majority (72.7%) of the respondents were having formal education. This is a good indication as most farmers would be able to read instructions.

Table 1. Socioeconomic characteristics of the farmers

Variables	Frequency	Percentage
Age of farmers (years)		
≤ 30	20	11.6
31-40	29	16.9
41-50	43	25.0
51-60	30	17.4
>60	50	29.1
Total	172	100.0
Sex of farmer		
Male	139	80.2
Female	33	19.2
Total	172	100.0
Educational status of the farmer		
No formal education	47	27.3
Primary education	46	26.7

Secondary education	54	31.4
Tertiary education	25	14.5
Total	172	100.0
Marital status		
Single	11	6.4
Married	156	90.7
Widow	5	2.9
Total	172	100.0
Nature of ownership of the farm		
Inherited	74	43.0
Purchased	74	43.0
Rented	12	7.0
Sharecropping	12	7.0
Total	172	100.0
Membership of socio-economic group		
Member	129	75
Non-member	43	25
Total	172	100.0

Source: Field survey, 2022

Table 2 shows that 61.1% of the farmers did not know about organic cocoa production while 34.9% claimed that they know organic cocoa production. However, 25% of those that claimed that they know about organic cocoa production got the information from CRIN. 93% of the respondents did not have organic cocoa farm.

Table 2. Status of organic cocoa production

Variables	Frequency	Percentage
Do you know about organic cocoa production?		
Yes	60	34.9
No	112	65.1
Total	172	100.0
If yes, from which source?		
CRIN	43	25.0
ADP	2	1.2
Farmer's Field School (FFS)	6	3.5
Television	1	0.6
Family friends	5	2.9
No response	115	66.9
Total	172	100.0
What is your understanding about organic cocoa production?		
Production of cocoa without using any chemical	88	51.2
Production of cocoa with exclusive use of chemicals	6	3.5
Production of cocoa with the use of both chemicals and botanicals	8	4.7
No response	70	40.7
Total	172	100.0
What do you think is the benefit derivable from organic cocoa production?		
Farmers are less exposed to chemical hazards	34	19.8

Soil ecology is conserved naturally	7	4.1
Increase in cocoa yield	4	2.3
Premium price	3	1.7
Produce devoid of chemical contaminations	1	0.6
All of the above	50	29.1
No response	73	42.4
Total	172	100.0
Do you have organic cocoa farm?		
Yes	12	7.0
No	160	93.0
Total	172	100.0

Source: Field survey, 2022

The soils of the two sites were slightly acidic ranging from 6.31 to 6.54 as shown in Table 3. Organic carbon and nitrogen contents of the soils were very low. Available phosphorus, exchangeable potassium and calcium of the soils of the two sites were also low and below the soil critical value for cocoa. Considering the low soil fertility status of the selected sites, organic amendment using organic fertilizer will be required to boost the productivity of the selected plantations while converting them to organic farms.

Table 3: Cocoa Plantations selected for conversion to Organic cocoa plots at Ibadan and Owena

Soil Properties	Ibadan	Owena
pH	6.31	6.54
Organic Carbon(g/kg)	0.096	0.109
N (g/kg)	0.011	0.01
P(mg/kg)	4.79	5.4
K(cmol/kg)	0.09	0.28
Ca(cmol/kg)	2.60	2.35

Mg(cmol/kg)	0.57	0.65
Na(cmol/kg)	0.30	0.35
Al+H(cmol/kg)	0.11	0.08
ECEC(cmol/kg)	3.66	3.72
Base Saturation (%)	97.00	97.85
Mn (mg/kg)	13.55	35.60
Fe(mg/kg)	31.75	25.70
Cu(mg/kg)	0.74	1.08
Zn(mg/kg)	2.69	2.43
Sand (%)	752	812
Silt (%)	174	134
Clay (%)	74	54
Textural class	Sandy loam	Loamy sand

Year of Report: 2021

Research Programme: Cocoa Programme

Title: CREATION OF AWARENESS AND DISSEMINATION OF CRIN DEVELOPED TECHNOLOGIES IN SELECTED COCOA GROWING COMMUNITIES IN CROSS RIVER STATE

Investigators: Uwagboe, E. O., Agbongiarhuoyi, A. E., Adedeji, A.R.

Abstract

Nigeria smallholder cocoa farmers are mostly engage in the marketing of raw cocoa beans to cocoa merchant who export the beans to the international markets. This practice has reduced the consumption of cocoa finished products and led to reduction in the revenue generated from cocoa production in the country. Multi-stage random sampling technique was used in the selection of the Local Government Areas, Communities and the cocoa farmers. The study reveals that majority (91.7%) of the farmers were male which implies that cocoa farming in the study area is largely dominated by male. Majority (46.7%) of the farmers were between

39 and 48 years old. The implication of this is that cocoa farmers in the LGAs are still in their productive years. Large proportion of the farmers in Etung and Ikom LGAs are not aware of Cocoa powder (91.7%), Cocoa Bread (90.1%), Cocoa wine (88.8%), Chocolate (86.9%), Liquid soap (89.4%), Black soap (87.5%), Cocoa cream (90.8%), Cocoa balm (94.2%). CRIN should continue with series of trainings on value addition to cocoa along the value chain and encourage farmers and other stakeholders in processing of cocoa to boost employment and revenue generation into the cocoa industry.

Introduction

Nigerian economy in the past decades depended greatly on agriculture as it provides employment opportunities for the teeming population and contributes to the growth of the economy (Oji-Okoro, 2011). The discovery of oil in the late 60's lead to a drastic shift from agriculture which was the central hub of Nigeria economy to crude oil production. Since the oil boom, agriculture, which was the major contributor to the Gross Domestic Product (GDP) of the country, has been relegated to the background (Jimoh, 2005).
Cocoa is a sub-sector in Nigeria's agriculture and it has been noted that it is capable of increasing not only per capita income; but can reduce spatial inequalities between rural and urban areas and reduce rural-urban migration (Abayomi, 2006**)**. Nigeria produce cocoa in fourteen out of its thirty six states and they are grouped into three categories according to their level of production. The groups are: higher producing states (Ondo, Cross River and Osun); medium producing states (Edo, Ogun, Oyo, Ekiti, Abia, Delta and Akwa-Ibom) and less producing states (Kwara, Kogi, Taraba and Adamawa)

Brief description of Cross River State

Cross River State is one of the 36 states of Nigeria. The present Cross River State came into being in September 1987 when the old Cross River State was split into Akwa Ibom and Cross River States. It is made up of parts of old Calabar and Ogoja Provinces divided into 18 administrative units' called Local Government Areas. The Local Government Areas include Obanliku, Obudu, Bekwara, Ogoja and Yala in the North Senatorial District, Boki, Ikom, Etung, Obubra, Abi and Yakurr in the Central District and Biase, Akankpa, Odukpani, Calabar Municipality, Calabar South, Akpabuyo and Bakasi in the Southern Senatorial District.). Out of a total of eighteen Local Government Areas (LGAs) in the state, fourteen (14) produce cocoa.

It lies between latitudes 5°32' and 4°27' North and longitudes 7°50' and 9°28' East. However, the Obudu and Obanliku Plateau with an altitude of 1,575.76 meters above sea level enjoys a climate typical of the temperate regions of the world National Population Commission (NPC) (2006).

Agriculture is the leading sector in Cross River State. It employs about 80% of the state's labour force, and contributes about 40% to the Gross Domestic Product (GDP). The most important cash crops are cocoa, coffee, cotton, bananas, rubber, palm oil and kernels and groundnuts. The main food crops are plantain, cassava, corn, millet and sugarcane. The state has modern agricultural estates and several smallholder farms in the local government areas. The climate allows growing a wide variety of crops. Export crops are the focus of agricultural production and research of the state with livestock, fishing and forestry as pillars of the economy.

In Cross River State subsistence farmers account for a greater proportion of cocoa farm holdings and they are the backbone of the agricultural sector in the state. The three Local Government Areas known to be the largest cocoa producing areas in the State are; Boki, Ikom and Etung.

Justification of the project

Nigeria smallholder cocoa farmers are mostly engage in the marketing of raw cocoa beans to cocoa merchant who export the beans to the international markets. This practice has reduced the consumption of cocoa finished products and led to reduction in the revenue generated from cocoa production in the country.

Some research surveys conducted by Cocoa Research Institute of Nigeria (CRIN), showed that many cocoa farmers are still unaware of the activities of CRIN Sub-station at Cross River state due to non-availability of processing unit at the station. The awareness of CRIN developed products is very low in some parts of the country which affects the value addition sector of cocoa value chain. There is need to investigate the level of awareness among farmers in the state in order to recommend ways to increase value addition and consumption to relevant stakeholders and policy makers. If there are gaps created by current practices of farmers, it is therefore necessary to create an awareness and sensitize cocoa farmers on the available technologies in CRIN for best global practices in cocoa procesing for sustainable production, improved livelihood and economic productivity to farmers in Cross River State.

Objectives

1. Identification of the cocoa growing communities in Cross River State

2. Introduction of CRIN Ajassor Sub-station to the cocoa farmers

3. Train the farmers on the activities of CRIN Ajassor Sub-station

4. Introduce some of the CRIN developed technologies to the farmers

5. Administer questionnaire to ascertain the level of awareness of some exhibited CRIN developed products

METHODOLOGY

Selection of locations and cocoa farmers

Four phases of selection was adopted in the selection of farmers in the project, in the first phase of the project, multi-stage random sampling technique was used in the selection of the Local Government Areas, Communities and the cocoa farmers. In stage 1: Two (2) Local Government Areas (LGAs) were selected. In Stage 2: Two (2) communities were selected based on contiguity and proximity to the farmers centers as follows**: Etung LGA**: Effraya and **Ikom LGA** Akparabong, the selection of only two centers for the exhibition was due to paucity of fund.

In stage Three (3): Sixty (60) farmers were selected from five (5) communities around Effraya and Akparapong giving a total of five (120) cocoa farmers. A pre-visit for the legitimization of the project was carried out using village facilitators in all the communities before the actual execution of the project. In each community some CRIN developed technologies (Black soap, Cocoa Powder, Cocoa cream, Cocoa balm, Cocoa and Kola wine) were exhibited for farmer's awareness and sensitization.

Results and Discussion

1.0 Socio economic characteristics of cocoa farmers in Etung and Ikom local government areas, Cross River State

Table 1 shows the socio-economic characteristics of cocoa farmers in Etung and Ikom Local
Government Areas (LGAs) of Cross River State. The table reveals that majority (91.7%) of the farmers were male. The implication of this is that cocoa farming in the study area is largely dominated by male gender and thus may be able to withstand the tasks of adopting value addition to cocoa produce by processing. Similarly, Girei et al (2013) reported that in Africa, men are more in a crop that is perceived to have commercial value. Majority (46.7%) of the farmers were between 39 and 48 years old. The implication of this is that cocoa farmers in the LGA are still in their productive years and thus cocoa production in the study area is expected to be on the increase for sustainable availability of raw materials for processing of cocoa products. However, this is not in consonance with the findings by Adeogun et. al (2010) and Adebiyi and Okunlola (2013) who reported that cocoa farmers in selected states of Nigeria were old and have passed their productive age.
Similarly, the table reveals that highest proportion (48.0%) of the farmers had access to secondary education. The implication of this is that the farmers may perhaps have access to information on value addition to cocoa along the value chain in respect to cocoa processing.

Table 1: Socio economic characteristics of the respondents

	Effraya LGA Sample size=60		Akparabong LGA Sample size=60	
Variables	Freq.	%	Freq.	%
Sex				
Male	55	91.7	53	91.7
Female	5	8.3	57	8.3
Age (Years) 39- 48 49 -58 Above 58	 28 19 13	 46.7 31.7 21.6	 30 17 13	 50.0 28.3 21.7
Educational Level Primary Secondary Tertiary	 17 29 14	 29.0 48.0 23.0	 11 37 12	 18.3 61.7 20.0

Source: Field Survey, 2021

2.0 Awareness of some CRIN technologies by farmers in Etung and Ikom Local Government Areas of Cross River State

Table 2 below revealed that very low proportion of the farmers were aware of some CRIN technologies exhibited. Some of the farmers that were aware could be attributed to attendance of training organized by CRIN which is a confirmation of positive impact the sub -station has made in the state. However, large proportion of the farmers in Etung and Ikom LGAs are not aware of Cocoa powder(91.7%), Cocoa Bread (90.1%),, Cocoa wine (88.8%), Chocolate (86.9%),, Liquid soap (89.4%), Black soap (87.5%), Cocoa cream (90.8%), Cocoa balm (94.2%) of the farmers has no knowledge. This is expected based on the unavailability of processing unit at CRIN Ajassor Sub-station. According to Adebola (2022), the federal and state governments are to encourage local consumption of cocoa as this will translate to economic benefit.

Table 2: Awareness of some CRIN technologies by the respondents

	Effraya % Sample size=60		Akparabong % Sample size=60	
Variables	Yes	No	Yes	No
Cocoa Powder	8.3	91.7	7.3	92.7
Cocoa wine	11.2	88.8	10.2	89.8
Cocoa Bread	9.9	90.1	9.7	90.3
Chocolate	13.1	86.9	12.5	87.5
Black soap	12.5	87.5	10.5	89.5
Cocoa cream	9.2	90.8	6.7	93.3
Cocoa Liquid soap	10.6	89.4	12.6	87.4
Cocoa Balm	5.8	94.2	7.8	92.2

Source: Field Survey, 2021

Conclusion and Recommendation

Based on the findings of this study, most of the CRIN technologies are not known by majority of the farmers who may be willing to invest in the processing of their produce into some of the products. CRIN should make these products available in large quantity to Cross River State to create awareness for interested investors and also establish processing unit at Ajassor Sub-station. Furthermore, CRIN should continue with series of trainings on value addition to cocoa along the value chain and encourage farmers and other stakeholders in processing of cocoa to boost more revenue generation into the industry.

References

Abayomi, F. (2006) An Overview of Nigerian Agricultural Sectors. Journal of Agricultural Economics, 8, 7-16.

Adebiyi S, Okunlola JO. Factors Affecting Adoption of Cocoa Farm Rehabilitation Techniques in Oyo State of Nigeria. World Journal of Agricultural Sciences. 2013;9(3):258-265.

Adebola,P. O. (2022) Nigeria should not rely on exporting cocoa alone. https://punchng.com/nigeria-should-not-rely-on-exporting-cocoa-alone-says-crin-ed/

Adeogun SO, Olawoye JE, Akinbile IA. Information source to cacao farmers on cacao rehabilitation tecniques (CRTs) in selected States of Nigeria. J. Media and Commun. Stud. 2010;2:009-015

Girei AA, Daura Y, Dire B. An economic analysis of groundnut (Arachis hypogeal) production in hong local government area of Adamawa State, Nigeria. Journal of Agricultural and Crops Research. 2013;1(6):84-89.

Jimoh A. (2005). "The malaria burden and agricultural output in Nigeria."Agrosearch Journal. 7(2): 43-50

Oji-Okoro, I., 2011, Analysis of the contribution of agricultural sector on the Nigerian economic development, World Review of Business Research, 1(1), 191 – 200.

Report of Nigeria's National Population Commission on Census (2006) Population and Development Review: Vol. 33, No. 1 (Mar., 2007), pp. 206-210 https://www.jstor.org/stable/25434601

2021 Research Report
Cocoa Research Program

Diagnostic Survey of Organic Cocoa Production in Nigeria and Selection of Conventional Cocoa plantations for Conversion to Organic

Ogunlade M.O., Adedeji A.R. Oyedokun V.A., Adejobi K.B, Oluyole K.A, Famuyiwa B. and Olasupo Festus

Introduction

Consumers' consciousness about the safety of what they consume and the increased awareness of the need for safety of the environment has brought organic cocoa production into the limelight. Organic cocoa is a bit more acidic and bitter (astringent) than normal cocoa. Organic cocoa is (mainly) used by premium chocolate brands to make chocolates. It is also used in personal care products as organic cocoa contains nutrients such as minerals,

vitamins, antioxidants and other essential analogues which are beneficial for maintaining a healthy skin. Demand for premium chocolate brand by consumers is increasing which is in turn escalating the demand for organic cocoa

Consumers are fond of chocolates but they are also conscious about their health which allows these chocolate brands to manufacture chocolate using organic cocoa. Consumers are demanding for natural chocolates without the use of any chemicals and artificial ingredients. Due to this, there is an increasing growth of organic cocoa market.

Nigeria has great potential for exploiting organic cocoa market as there is large market demand for organic cocoa in developed countries especially in Europe and America.

This study aimed at

c. determining the status of organic cocoa production in Nigeria
d. producing organic cocoa by:

iv. Converting cocoa plantation from conventional to organic farming
v. New establishment of organic cocoa while ensuring compliance with requirements of organic certification with a view to extend the technology to Nigerian cocoa farmers.
vi. Improving the income and sustainable livelihood of an average cocoa farmer in Nigeria

Methodology

Diagnostic survey

The survey was conducted in three Southern States in Nigeria. The States were Ondo, Oyo and Cross River States. In each of the States, three cocoa producing cocoa producing local government areas (LGAs) were purposively selected for the study. In each of the chosen LGAs, one community was selected thus making a total of nine communities chosen for the study. A total of 172 respondents were randomly selected for the study. Information was collected from the respondents with the use of structured questionnaire. The data retrieved from the information collected were analysed using descriptive statistics.

Selection of conventional cocoa plantations for conversion to organic cocoa farm

One cocoa plantation at CRIN Headquarters located at Zone 9 with Latitude 7.21348833 and longitude 3.854928 was selected. Ten core soil samples were collected randomly from the selected plot at two depths of 0-20cm and 20 - 40cm. The core samples were bulked into two composite samples for each of the depth. In Owena, a cocoa plantation located within latitude 7.201258333 and longitude 5.026525 was selected. Ten core soil samples were also collected randomly at two depths and bulked int two composite samples.
The soil samples were air dried under room temperature, sieved through 2mm sieve and sent to the laboratory for routine analysis using standard laboratory methods.

Results and Discussion

Table 1 shows the socioeconomic characteristics of the respondents. The Table shows that majority (80.2%) of the respondents were males while 46.5% of the respondents were above 50 years of age. The Table also shows that majority (72.7%) of the respondents were having formal education. This is a good indication as most farmers would be able to read instructions.

Table 1. Socio-economic characteristics of the farmers

Variables	Frequency	Percentage
Age of farmers (years)		
≤ 30	20	11.6
31-40	29	16.9
41-50	43	25.0
51-60	30	17.4
>60	50	29.1
Total	172	100.0
Sex of farmer		
Male	139	80.2
Female	33	19.2
Total	172	100.0
Educational status of the farmer		
No formal education	47	27.3
Primary education	46	26.7
Secondary education	54	31.4
Tertiary education	25	14.5
Total	172	100.0

Marital status		
Single	11	6.4
Married	156	90.7
Widow	5	2.9
Total	172	100.0
Nature of ownership of the farm		
Inherited	74	43.0
Purchased	74	43.0
Rented	12	7.0
Sharecropping	12	7.0
Total	172	100.0
Membership of socio-economic group		
Member	129	75
Non-member	43	25
Total	172	100.0

Source: Field survey, 2022

Table 2 shows that 61.1% of the farmers did not know about organic cocoa production while 34.9% claimed that they know organic cocoa production. However, 25% of those that claimed that they know about organic cocoa production got the information from CRIN. 93% of the respondents did not have organic cocoa farm.

Table 2. Status of organic cocoa production

Variables	Frequency	Percentage
Do you know about organic cocoa production?		
Yes	60	34.9

No	112	65.1
Total	172	100.0
If yes, from which source?		
CRIN	43	25.0
ADP	2	1.2
Farmer's Field School (FFS)	6	3.5
Television	1	0.6
Family friends	5	2.9
No response	115	66.9
Total	172	100.0
What is your understanding about organic cocoa production?		
Production of cocoa without using any chemical	88	51.2
Production of cocoa with exclusive use of chemicals	6	3.5
Production of cocoa with the use of both chemicals and botanicals	8	4.7
No response	70	40.7
Total	172	100.0
What do you think is the benefit derivable from organic cocoa production?		
Farmers are less exposed to chemical hazards	34	19.8
Soil ecology is conserved naturally	7	4.1
Increase in cocoa yield	4	2.3
Premium price	3	1.7
Produce devoid of chemical contaminations	1	0.6

All of the above	50	29.1
No response	73	42.4
Total	172	100.0
Do you have organic cocoa farm?		
Yes	12	7.0
No	160	93.0
Total	172	100.0

Source: Field survey, 2022

The soils of the two sites were slightly acidic ranging from 6.31 to 6.54 as shown in Table 3. Organic carbon and nitrogen contents of the soils were very low. Available phosphorus, exchangeable potassium and calcium of the soils of the two sites were also low and below the soil critical value for cocoa. Considering the low soil fertility status of the selected sites, organic amendment using organic fertilizer will be required to boost the productivity of the selected plantations while converting them to organic farms.

Table 3: Cocoa Plantations selected for conversion to Organic cocoa plots at Ibadan and Owena

Soil Properties	Ibadan	Owena
pH	6.31	6.54
Organic Carbon(g/kg)	0.096	0.109
N (g/kg)	0.011	0.01
P(mg/kg)	4.79	5.4
K(cmol/kg)	0.09	0.28
Ca(cmol/kg)	2.60	2.35
Mg(cmol/kg)	0.57	0.65
Na(cmol/kg)	0.30	0.35
Al+H(cmol/kg)	0.11	0.08
ECEC(cmol/kg)	3.66	3.72

Base Saturation (%)	97.00	97.85
Mn (mg/kg)	13.55	35.60
Fe(mg/kg)	31.75	25.70
Cu(mg/kg)	0.74	1.08
Zn(mg/kg)	2.69	2.43
Sand (%)	752	812
Silt (%)	174	134
Clay (%)	74	54
Textural class	Sandy loam	Loamy sand

2021 RESEARCH REPORT

RESEARCH PROGRAMME: **Cocoa**

Title: "On-Farm Demonstration of CRIN Liquid Soap to farmers in 2 locations in Southwestern Nigeria toward sustainable livelihood".

Investigators:Yahaya L.E, Adedeji A.R, Adebiyi S.

Introduction:Cocoa cultivation remain one of the major agricultural practices in the South western part of Nigeria. This has always been a source of income to the farmers that engage in this practice. However, most of these farmers are peasant and most often generate little from their cultivation due to small size farming. Also, women are equally involved in the cocoa business and as such will have to engage in other farming practices that will support what they already have. Soap production is one of such practices that can be involved in and that will generate revenue to the would-be- investor. One of the raw material, Cocoa pod husk is readily available on the farm which often liters the entire farm. The training was carried out to help farmers to diversify into soap production and be able to generate income for them and consequently sustaining their living. This training has aslo helped to clean up the farm environment, hence reducing pathogenic host which would been caused by heaps of rotten cocoa pod husks.

Materials and Method: Farmers were trained on soap production using cocoa pod husk. This was done using the participatory approach method. The saponification process as modified by Yahaya *et al*, 2004 for soap production was employed while involving the farmers in the production process. Farmers were made to participate in the training so that they can have

mastery over the process of production and were able to take up the skill at the end of the training.

Results and Discussion: At the end of the training session, participants were fully acquainted and equipped with the method and skills of producing liquid soap using cocoa pod husks. They were also happy to have received the training on soap production using a seemingly waste material. Many among the participants promised to take up the technology as a means of livelihood.

Conclusion and Recommendation: It was practically obvious that soap training among cocoa farmers is possible. It was a fruitful experience among the participants. It is therefore recommended that this type of training should be extended to other cocoa producing areas to maximize the value addition of their crop.

References:

1.Yahaya, L.E; Hamzat, R.A, Aroyeun, S.O and Odufuwa, M.I, (2002). Production of liquid detergent from the pod husk of kola (Cola nitida) Moor Journal of Agricultural Research. 3, 253-256

2.Wilkinson, R N (1974).” Detergents” in chemicals and process technology Encyclopedia. McGraw Hill, New York.

2021 Research Report

Cocoa Research Programme

Diversity based on DNA sequencing of Lasiodiplodia spp. and Phytophthora spp. Associated with Cashew and Cocoa Diseases in Nigeria

Adeniyi, D.O. and Adedeji, A.R.

Introduction

Cocoa is an important cash crop and major source of income to many smallholder farmers in the forest region of West Africa. It is estimated that 90 % of worldwide cocoa production comes from smallholdings and most of this production occurs in areas of high biodiversity of varieties and pests’ complexes. Several factors have contributed to decline and dwindling production of cocoa of which black pod disease is key factor (Adegbola, 1972). There is rare report of diplodia pod rot disease of cocoa in growing countries of the world, it is classified as an invasive species on cocoa. Cashew is very prone to wide range of pathogens which infect different parts: stems, leaves, inflorescences, apples and nuts resulting into significant and economic losses in yield and quality. Phytophthora megakarya is the most aggressive fungal pathogen on Theobroma cacao L. and poses a major threat to production. It was originally identified in Nigeria in 1979 (Brasier et al., 1981).

Currently, P. megakarya is the predominant species responsible for black pod disease of cocoa in the sub region (Opoku et al., 1997, 2000). Every stage of pod development is susceptible to infection, but immature pods are the most susceptible. Pod rot symptoms due to P. megakarya however, are characterized by multiple lesions which spread fast and coalesce with an abundant bloom of white zoosporangia on the lesion except for about a centimetre from the advancing margin. Phytophthora megakarya has become the main yield-limiting factor for cocoa production in affected areas (Opoku et al., 2000), the documented host range of P. megakarya is limited. Lasiodiplodia theobromae is a cosmopolitan fungus with a worldwide distribution in the tropics and subtropics with a wide host range. This pathogen has been associated with pod rot of cocoa and causes blight and dieback of cashew inflorescence and twigs in Nigeria. This study however focuses on established pathogens of pod rot and black pod of cocoa, inflorescence blight and twig dieback of cashew and subjected to DNA sequencing to determine diversity or similarity on cocoa and cashew.

Methodologies

Study location: Field survey was carried out during cocoa pod production and cashew fruiting, targeting major pathogens of the crops in in Ondo, Oyo and Cross rivers state. Cocoa pods showing typical symptoms of pod rot and black pod were aseptically collected from farms in selected communities (Figure 1). Disease samples were collected in sterile Ziplock sample bags and isolation procedure carried out at the laboratory of CRIN. The infected samples were subjected to routine sterilization, inoculated on selected growth media and incubated at appropriate temperature for 7days. Pure cultures of isolates were transferred to Inquaba laboratory facility, for morphological character descriptions, identification and nucleotide sequences according to Kwon et. al., 2011.

Figure 1: Map showing area of sample collection points

Results and Discussion

Percent occurrence of associated fungi with diseased parts and crops varied with study locations, with a total of eight genera on cocoa and cashew. Each of Lasiodiplodia theobromae and Aspergillus niger had highest occurrences (25%), A. flavus, Colletotricum gloeosporoides and Aspergillus spp. had 3.6%. Phytophthota megakarya had 7.1%, 14.3% and 17.8% of Fusarium spp. and Botryosphaeria mamane respectively (Figure 2).

Figure 2: Occurrence of isolates with disease conditions of cocoa and cashew

Lasiodiplodia theobromae, A. niger and Fusarium spp. were cultured from pod rot at Bolorunduro, Owena, Idanre and Akure (Ondo state). Botryosphaeria mamane, A. flavus and Fusarium were also present in Ondo state. Botryosphaeria mamane, shared similar features with L. theobromae and common in black pod in all locations except Akure. Pod rot at Idanre also recorded B. mamane. Colletotricum gloeosporoides was also cultured from inflorescence blight (Table 1). Colletotricum gloeosporoides has been reported as causing diseases on inflorescence, twig, nuts and anthracnose in Tanzania (Zhongrun and Masawe, 2014), however this study is the first report of C. gloeosporoides from inflorescence blight of cashew in Nigeria, although pathogen is associated with anthracnose disease. Record of Lasiodiplodia pod rot of cocoa was rare in Nigeria except for the incidence of pathogen on

young cocoa seedling causing dieback, the disease was first reported in Bangladesh in 2010 (Shamsi et. al., 2010)

Variations were reported in morphological characters: growth rate, sporulation, pycnidial production, colony texture and colour of Lasiodilplodia spp. in cashew inflorescence. Although all Lasiodiplodia isolates have one septation, but the septa size and conidial dimension also varied with isolates source across study locations (Adeniyi et. al., 2016).

Table 1: Mycoflora associated with disease conditions of cocoa and cashew

Disease condition/crop		Location
Pod rot/cocoa	Black pod/cocoa	Cashew blight/dieback
L. theobromae	B. mamane	Bolorunduro
A. niger		
L. theobromae	B. mamane	Owena
A. niger	A. niger	
B. mamane	B. mamane	Idanre
Fusarium spp.	Fusarium spp.	
L. theobromae	L. theobromae	Akure
A. niger	Fusarium spp.	
Fusarium spp.		
L. theobromae	P. megakarya	Inflorescence blight: L. theobromae, A. niger, C. gloeosporoides Idi-Ayunre
Aspergillus spp.		Twig dieback: L. theobromae, A. niger
Fusarium spp.		Nut blight: L. theobromae, A. niger
	P. megakarya	Ajassor

The nucleotide sequences of isolates initially reported as L. theobromae through morphological descriptions showed L. pseudotheobromae (CUZF1QNA), L. pseudotheobromae (PLM-590A), Botryosphaeria rhodina (UCD1028BC), L. theobromae (670004), and L. theobromae (isolate 8) from cashew inflorescence (Adeniyi and Asogwa, In-press) and occurrence of Cophinforma atrovirens on inflorescence of cashew was first reported in Nigeria in 2020 (Adeniyi et. al., 2020). In this study, L. theobromae also showed varied strains in pod rot of cocoa: L theobromae (ELS4), cultured at Bolorunduro, L. pseudotheobromae (UY1356) at Owena, B. mamane (CBS117444) at Idanre and L. theobromae (BT02) isolated at Akure. The L. theobromae (zm13581) was cultured from black pod disease and pod rot of cocoa at Idi-Ayunre, Oyo state while Aspergillus species and Fusarium were associated with pod rot at Idi-Ayunre. Varied strains of P. megakarya were cultured from black pod at Idi-Ayunre (Oyo state) and Ajassor (Crossrivers state), PPG4 and 61J5 strains respectively. The L. theobromae were also occurred in varied strains in cashew disease conditions; GUCC9240, SKJM1103 and gi from inflorescence blight, twig dieback and nut blight respectively at Idi-Ayunre, Oyo state. Aspergillus niger was commonly associated Lasiodiplodia species on cashew (Table 2).

Deoxyribonucleic acid (DNA) sequences from the NCBI nucleotide database were aligned using ClustalW, and a phylogenetic tree from consensus nucleotide sequences was constructed using the neighbor joining method and visualized with Tree View. Numbers above the branches indicate bootstrap values. Bars indicate number of nucleotide substitutions per site. The present isolate infecting Theobromae cacao and Anacardium occidentale were is marked in italics (Figure 3).

Table 2: Nucleotide sequences of pathogenic isolates in cocoa and cashew

Target crop	Matched organism		Location
Cocoa	Pod rot	Black pod	
	L. theobromae (ELS4)	B. mamane (CBS 117444)	Bolorunduro
	L. pseudotheobromae (UY1356)	B. mamane (CBS 117444)	Owena
	B. mamane (CBS 117444)	B. mamane (CBS 117444)	Idanre
	L. theobromae (BT02)	L. theobromae (BT02)	Akure
	L. theobromae (zm13581)	P. megakarya (PPG4)	Idi-Ayunre
	B. mamane (CBS 117444)		Idi-Ayunre
	P. megakarya (61J5)		Ajassor

Cashew	Inflorescence	Twig	Nut	
	L. theobromae (GUCC9240)	L. theobromae (SKJM1103)	L. theobromae (gi)	Idi-Ayunre

Figure 3: Phylogenetic tree using internal transcribed spacer (ITS) sequences showing closest known relatives of Lasiodiplodia and Phytophthora.

Conclusion and Recommendation

Morphological description showed that B. theobromae is common to all disease conditions and P. megakarya cultured from specific locations. However, nucleotide sequences of same isolates showed diverse species identities. Botryosphaeria mamane (black pod), L. pseudotheobromae (pod rot), different strains of P. megakaya (Cross river (strain 61J5), Oyo (strain PPG4). Lasiodiplodia theobromae (pod rot) but of varied strains and likewise were the strains of L. theobromae (twig, inflorescence, nuts). The genetic diversity in this study indicates knowledge gap in previous identity of Lasiodiplodia species and P. megakarya in Nigeria.

References

Adegbola, M.O.K. 1972. Cocoa diseases of West Africa, 7th International Cocoa Research Conference, Douala, Cameroon pg179-184

Adeniyi, D.O., D. A. Animasaun, O.T. Oduoye and R. Krishnamurthy (2020). First Report of Cophinforma atrovirens and Trichoderma ghanense Associated with Inflorescence Dieback of Cashew and Soil in Nigeria". Acta Scientific Agriculture 4(5): 25-27.

Adeniyi, D. O., Olufolaji, D. B. and Joseph, A. (2016). Characteristic Variations in Lasiodiplodia theobromae; Pathogen of inflorescence Dieback of Cashew in Growing Ecologies of Nigeria. Annual Research &Review in Biology 10(2): 1-6, 2016.

Adeniyi, D. O. and E. U. Asogwa (In-press). Dynamics of Cashew Diseases and Insect – pests in Agro-ecologies of Nigeria. Forest Microbiology, Elsevier, Volume 2.

Brasier, C.M., Griffin, M.J., Ward, M.R., Idowu, O.L., Taylor, B., Adedoyin, S.F., Adebayo, A.A., 1981. Epidemiology of Phytophthora on Cocoa in Nigeria. Final Report of the International Cocoa Black Pod Research Project. Phytopathological Papers, p. 188.

Kwon, Jin-Hyeuk, Jinwoo Kim and Won-Il Kim (2011). First Report of Rhizopus oryzae as a Postharvest Pathogen of Apple in Korea. Mycobiology 39(2): 140-142.

Opoku, I.Y., Akrofi, A.Y., Appiah, A.A., 1997. The spread of Phytophthora megakarya on cocoa in Ghana. In: Proc. 1st Int. Cocoa Pests and Diseases Seminar, Accra, Ghana, 6 to10 November, 1995.

Opoku, I.Y., Appiah, A.A., Akrofi, A.Y., Owusu, G.K., 2000. Phytophthora megakarya: a potential threat to the cocoa industry in Ghana. Ghana J. Agric. Sci. 33, 237e248.

Shamsi, S., Naher, N. and Momtaz, S. (2010). First report of Lasiodiplodia pod rot of cacao (Theobromae cacao) from Bangladesh. J. Plant Path. 2010 26 1/2 81-82. ISSN 1012-9279.

Zhongrum, Z. and Masawe, P.A.L. (2014). Diseases and Insect pest of cashew in Tanzania. Tropical Crops Genetic Resources Institute and Naliendele Agricultural Research Institute. ISBN: 9987-446-09-4. 54p.

2021 RESEARCH REPORT

RESEARCH PROGRAMME: TEA

TITLE: FIELD ESTABLISHMENT OF TEA UNDER VARYING WATERING REGIME AND DIFFERENT SHADE LEVELS IN LOWLAND AGRO-ECOLOGIES OF NIGERIA

Investigators: Ade/osun, S.A., Aiyegboyin, K. O., Akanbi, O. S. O., Yahaya A.T and Famuyiwa, B.S.

Introduction

The discovery of tea is dated back to 2700 BC by Chinese Emperor, Shen-Nunga. (Oi, 2004; Famaye *et al*., 2006). Since its discovery, its cultivation has spread to many parts of the world including Nigeria. Its beverage has been reputed for high level of antioxidant with its attendant health benefits of lower susceptibility to cancer and cardio-vascular diseases (Balentine, 2001); helping to prevent heart diseases (Mitscher *et al*., 2001) and being anti-inflamatory, antifibriotic and a cardioprotective agent (Aroyeun *et al*., 2013). An evenly distributed rainfall of 1500-3000mm is required for optimum growth and development of tea (Bonheure, 1991). Tea thrives under ambient temperature of 18-30 ^{0}C (Jannedra *et al.,* 2007) and dies at temperature of <5 ^{0}C and >30 ^{0}C. Tea thrives well on Mambilla highlands owing to its cool climate, and slightly acidic soil (Ipinmoroti, 2006). However, the warm temperature in lowland of Southern Nigeria is detrimental to tea growth.

Justification

Tea, when exposed to full day light, hot and dry air in the lowland, dies and fails to survive the first dry season (Adeosun *et al*., 2019), thereby jeopardizing its growth and establishment in the field. However, tea has been grown successfully in plastic pots under palm fronds sheds and on the field under natural shade of plantain (Adeosun *et al*., 2019 and 2022). Besides, inadequate and poorly distributed rainfall in the greater part of the year in the lowland has successfully constrained tea production in this area. This called for the need to fashion means of ameliorating the harsh weather of the dry season in order to maintain tea growth and development all year round and ultimately ensure high field establishment. That is the essence of this trial. Cessation of rain in the dry season has made irrigation inevitable. Although, there is extremely dearth of information on artificial application of water to tree crops to enhance their field establishment, information obtained from field experience shows that cocoa farmers have to practice manual irrigation in order obtain high field establishment in successive dry seasons after seedling transplant. Therefore, this trial was aimed at assessing the growth and field seedling establishment of tea plants under varied watering regime and different shade levels in Ibadan, Uhonmora and Ajassor.

Objectives

1. To determine the effects of watering on the growth performance of established tea cuttings during the dry season.
2. To determine the optimum water regime that would enhance ≥70% seedling survival at the end of the second dry season after seedling transplant.
3. To determine the interaction effects of watering regime and plantain shade on survival rate of cultivated tea plants at first two dry seasons after seedling transplant.

Materials and Methods

This experiment was carried out Ibadan (Oyo State), Uhonmora (Edo State) and Ajassor (Cross Rivers State). It is a factorial of 3 factors which include plantain shade at 2 levels (plantain shade and zero shade), 4 watering regimes - watering at 2 L/day, 2 L/in 2days, 2 L in 3days, zero watering (as control); 2 tea cultivars (143 and 318) giving 16 treatment combinations laid out in Randomized Complete Block Design (RCBD) arranged in Split-Split Plots with 3 replications. The shade levels served as main plots, watering regimes as subplots and tea cultivars as sub-subplots. A gap of 2m was created between the subplots. A suitable site of 0.2 ha was selected. The land was cleared of vegetation and field layout was done. Composite soil samples were collected from the sites for pre-cropping laboratory analysis for physico-chemical soil properties. Plantain suckers were planted at a spacing of 3 x 1.5 m (Adeosun *et al.,* 2022). The established plots were weeded 3 times per annum. Two thousand (2000) tea cuttings (Cultivars 143 and 318) were raised in CRIN Substation, Mambilla, Taraba State.

Results and Discussion: The result of pre-cropping soil physico-chemical properties is being awaited. The project is ongoing

Conclusion and Recommendations: The project is ongoing

References

Adeosun, S. A., Togun, A. O., Adejumo, S. A. and Famaye, A. O. (2019). The effect of cocoa pod husk as organic fertilizer on the growth of tea (C*amellia sinensis* (L) O. Kuntze) under varying light intensities in Ibadan – South West Nigeria. *Journal of Global Biosciences Vol. 8 No.2 Pp5916-5989*

Aroyeun, S. O., Shittu, T. R., Yahaya, A. T., Sowunmi F. A., Ondubaku L. A., Okelana F. A. and Akoroda M. O. (2013). Green Tea Processing in Nigeria and its Economic Implications. *Global Advanced Research Journal of Management and Bussiness Studies. Vol. 2(1) Pp. 050-055*

Balentine, D. A. (2001). The role of tea flavonoids in cardiovascular health. *Proceedings of International conference on O-Cha (Tea) Culture and Science, Shizuoka, Japan. October 5-8 2001. Pp. 84-89.*

Bonheure D. (1991) TEA. The Tropical Agriculturist. (Macmillan Ltd. 1991) Pp 1-54.

Famaye, A. O., Oloyede, A. A., and Ayegboyin, K. O. (2006). *Hand Book on Tea Production in Nigeria*. Akure: Pamma Press. ISBN 978-072-546-6 pp 1-14

Ipinmoroti, R. R. (2006). Assessment of growth and productivity of tea (*Camellia sinensis*) seedlings as influenced by organomineral and NPK fertilizers in Ibadan and kusuku, Nigeria. Ph.D Thesis, University of Ibadan. Pp15-18.

Janendra, W. A., De Costa, M., Mohotti, A. J., Wijeratne M. A. (2007) Ecophysiology of Tea. *Braz. J. Plant Physiol. Vol. 19 no.4 pp.1-3*

Mitscher, L., Pillai, S., Pillai, C. and Shankel, D. (2001). Antibiotic resistance preventive properties of green tea. *Proceedings of International conference on O-Cha (Tea) Culture and Science, Shizuoka, Japan. October 5-8 2001. Pp. 1-4*

Oi, N., Sakakibara, Hiroyuki, H., Fujiwara, S., Ito, C., Li, C., Das, S. K., Wu, B. and Kanazawa, K. (2004). Comparison of tea components among the six great Chinese teas. *Proceedings of International Conference on O-Cha (Tea) Culture and Science Shizuoka, Japan November 4-6 2004. Pp.615-616*

Seun Adewale Adeosun, Adeniyi Olumuyiwa Togun, Kayode Babatunde Adejobi and Kayode Olufemi Aiyegboyin (2022). Growth and seedling establishment of tea

(*Camellia sinensis* (L) O. Kuntze) under varying plantain shade in Southwest Nigeria. *World Journal of Advanced Research and Reviews*, *2022*, *13(01)*, *638–646*

2021 RESEARCH REPORT

RESEARCH PROGRAMME: TEA

TITLE: INTERCROPPING OF TEA WITH EUCALYPTUS: IMPLICATION ON SOIL FERTILITY AND GREEN TEA QUALITY PARAMETERS

Investigators: Aikpokpodion P.E, Okunade A.F and Asowata F.E.

Introduction

Tea cultivation on the Mambilla plateau is common among farmers on the plateau due to favorable climatic and soil conditions. Most of the farmers are small scale farmers with small land holdings. Despite the fact that Mambilla plateau is good for tea cultivation, availability of land for large scale tea farming is limiting because, greater proportion of the land on the plateau is used for grazing. Hence, farmers are left with limited area of land for cultivation. In order to maximize land use, 74% of tea farmers intercrop tea with varieties of crops. Some intercrop tea with arable crops like maize and beans while 41.10 % intercrop tea with eucalyptus which is the only source of timber on the Mambilla plateau. Another reason why tea farmers intercrop tea with eucalyptus is the poor financial returns from the sale of tea leaves. In order to augment financial returns from farming, the farmers purposely plant eucalyptus among tea stands for the purpose of being sold as timbers after 8 – 10 years. Eucalyptus being a perennial crop can be nutrient and water demanding which could lead to nutrient deficiency in tea soil as a result of competition for nutrient and water. In order to evaluate if the combination of both crops on same land has significant impact on tea quality and nutrient availability, it became necessary to

Objectives

To evaluate the impact of tea-eucalyptus intercrop on nutrient status of the soil
To evaluate the impact of tea-eucalyptus intercrop on tea quality with respect to bioactive polyphenolic compounds in tea leaves
To evaluate the impact of tea-eucalyptus intercrop on soil chemical parameters

Materials and methods

Soil samples and tea leaves (1 leaf and 1 bud) were collected from selected tea-eucalyptus intercropped farms in Kusuku, Kakara and Sabongari at the depth of 0-20cm with soil auger. Since the study was a comparative investigation, similar sampling was equally done in adjacent mono-cropped tea farms. The samples were collected from ten (10) points within each farm and mixed together to form a composite sample. The obtained composite soil samples were air-dried in the laboratory under ambient temperature. And sieved with 2mm

sieve. The tea samples were subsequently processed into green tea according to standard procedure.

Soil analysis

Determination of macronutrients was done by leaching the samples with 1N ammonium acetate. The leachate was analyzed for exchangeable cations (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}) determination according to Schollenberger and Simeon (1945). Soil pH was measured with glass electrodes in 1:1 soil-water suspension. The organic carbon was determined according to Walkley and Black (1934). Total Nitrogen was determined by the Macro Kjedahlmethod (Bremner,1996). Available Phosphorus was determined using Mehlich 3 method (Mehlich, 1984). Mehlich 3 extracting solution was preferred to Bray 1 solution owing to the inability of Bray 1 solution to extract available phosphorus from the soil samples at detectable level.

Determination of Polyphenolic derivatives in green tea samples

Caffeine, epicatechin, epigallocatechin, epigallocatechin gallateand gallic acid determination was done according to the methods of Allen, (1979) while total phenol was determined according to Titto, (1985).

Results and Discussion

Soil sample analysis shows a percent increase of 4.6, 4.6, 9, 17, 10.24, 64, 23, 12 27, and 13% in the concentration of pH, available Phosphorus, exchangeable K, Ca, Mg, total nitrogen, organic carbon, Cu, Zn and Mn respectively in tea plantations intercropped with eucalyptus in Kusuku compared with tea farms without eucalyptus intercrop (Table 1). The same observable increase in soil nutrients was recorded for tea farms intercropped with eucalyptus trees in Kakara and Sabongari compared with mono-cropped tea farms within the same environment (Table 1).

The increase in soil macro and micronutrients in plantations with tea-eucalyptus intercrop was mainly due to the increased in soil organic matter from the leaf litter of eucalyptus tree. The organic matter decompose and undergo mineralization which causes a built up of soil organic matter. This also serves as substrate for soil biota and enhances microbiological activities within the soil. The soil ecosystem is also drastically improved by the presence of canopy formed by eucalyptus trees. The trees serve as wind and prevent wind erosion of top soil within the tea-eucalyptus intercropped farms. Trees significantly enhance soil organic matter in a cropping system by 50-100% in many cases through pruning, litter fall, root slough and exudates (Young, 1989). This additional organic matter serves as increased food for microbes, which in turn boost soil microbiological activities by 30% (Young, 1989). The increased soil organic matter that trees add to farm also result in higher cation exchange capacity in soils which allows soils to retain nutrients and prevent leaching. According to Liu and Balasubramanian (2012), eucalyptus leaf contains 46% carbon and

1.23% nitrogen. The nutrients locked up in the leaves are made available for plant uptake when they undergo decay and mineralization. Sarkar et al, (2010) also reported an increase in soil pH, organic matter, total N, available P, exchangeable K, Ca and Mg in soils due to leaf litter fall. Apart from increase in soil fertility, soil structure is also enhanced by the decay and mineralization of leaf liter fall. Shankarnarayan (1984) reported an increase in organic matter, nitrogen and phosphorus on soil under crop intercropped with trees compared with *Prosopis* species of same farm without trees. Under agroforestry system involving *Populus deltoids* and eucalyptus hybrid canopies, enhancement in soil nutrient was 33-83% organic carbon, 38-69% nitrogen, 3-33% available phosphorus (Anonymous, 1987)

Result of green tea analysis shows that total phenol ranged from 8618 - 9593mg/100g green tea from mono-cropped tea farms across the selected farms in Kusuku. Kakara and Sabongari (Table 2). On the other hand, total phenol in tea harvested from tea-eucalyptus intercrop ranged from 8761 – 9756mg/100mg sample with an increase of 1.7, 1.04 and 1.67% in tea sample from Kusuku, Kakara and Sabongari respectively compared with mono-cropped tea. In a similar manner, caffeine content of tea intercropped with eucalyptus also increased by 5.42, 5.26 and 3.4% compare with mono-cropped tea obtained from the selected tea farms in Kusuku, Kakara and Sabongari respectively. Gallic acid in tea sample from mono-cropped tea ranged from 2450-2464mg/100g sample while it ranged between 2531 and 2637mg/100g of tea sample obtained from tea-eucalyptus intercropped farms. Gallic acid increased by 7.0, 2.17 and 3.31% in tea samples obtained from tea-eucalyptus intercrop compared with monocroped tea in samples from Kusuku, Kakara and Sabongari respectively (Table 2). Epicatechin in tea sample from tea-eucalyptus intercrop increased by 12.6,18.7 and 13.91% compared with tea samples from mono-cropped tea farms in Kusuku, Kakara and Sabongari respectively. Similarly, epigallocatechin increased by 4.95, 3.98 and 8.22% in tea samples from tea-eucalyptus intercrop in relation to samples from mono-cropped tea farms selected in kusuku, Kakara and Sabongari respectively. Epigallocatechin-3-gallate in tea samples from tea-eucalyptus intercrop increased by 20.31, 12.93 and 15.44% compared with tea samples from selected mono-cropped tea farms in Kusuku, Kakara and Sabongari respectively. Epigallocatechin (EGC), Epigallocatechin (EGC), Epicatechin gallate (ECG), Catechin gallate(CG) and Gallo catechin (GC) increased in all samples obtained from tea farms intercropped with eucalyptus compared with samples from farms solely cropped with tea.

Catechins are the main bioactive molecules in tea and are the most frequent (Cabrela et al. 2003), the six catechin derived polyphenols in tea leaves are epicatechin, epicatechin gallate, gallocatechin, epigallo catechin and epigallocatechin gallate. Catechin accounts for 6-12% of the dry tea weight of green tea leaves with ECGC containing 10-50% and being the most bioactive due to its degree of gallation and hydroxylation (Stewart et al. 2004). The health benefits of green tea has been attributed to the strong antioxidant activity of catechins and other polyphenolic compounds (karori et al. 2007) that protect the body

against free radical induced oxidative stress (Pourmorad et al. 2006). In addition, tea phenolic compounds have been associated with amelioration of inflammation (Kakori et al. 2008), Inhibition of diabetes (Sabu et al. 2002), Prevention of intestinal damage and anti-diarrhea properties (Astar et al. 2003). Polyphenols have been found to enhance oral health (Wu and Wei, 2002) and the potential to improve cognitive learning ability.

The increased concentration of catechins and its derivatives in tea samples obtained from tea-euclyptus intercrop must have been influenced by two factors. First is the improved soil organic matter occasioned by leaf litter fall from eucalyptus trees and the second factor is attenuation of direct solar ultraviolet radiation scourge on tea plant by eucalyptus canopy cover. The increased soil organic matter in soils under eucalyptus intercrop created conducive environment for microbial activities which enhanced the enzymatic oxidation of polyphenols in tea crop under eucalyptus. The synthesis of bioactive compounds in tea under eucalyptus intercrop must also have been enhanced by the boosted ecosystem created by the canopy cover of eucalyptus.

The second factor is connected to reduction of the direct solar radiation getting to the tea crop under eucalyptus intercrop. Currently, the impact of climate change and global warming with its attendant increase in temperature cannot be denied. The ultraviolet portion of solar radiation has a higher penetrating power than the visible part of the solar radiation. Direct irradiation of intense sunshine on sunny days especially during the dry season can be harmful to young shoots of tea plant. When the temperature of air around the surface of tea leaf is higher than the temperature of the leaf, tea plant closes its stomates in attempt to control moisture loss through evapotranspiration. This mechanism is put in place to prevent water stress in the tea plant. During stomates closure, absorption and translocation of water and nutrients from the soil to tea plant is slows down since the closed stomates are not readily opened for transpiration and exchange of gas at the leaf surface. In situation where the temperature is so intense, the closure of stomates to reduce water loss from the tea plant is overwhelmed and the tea plant significantly losses water through excessive transpiration leading to water stress and may even cause the death of affected plant if there is no external intervention. On the other hand, such scenario is not likely to happen in tea intercropped with eucalyptus in which the canopy cover from eucalyptus trees serve as barrier and filter direct solar radiation getting to the young tea shoots by cutting off near infrared solar flux and transmit sufficient light intensity for optimum photosynthesis. Shading by trees provides a number of known benefits to tea plantations including microclimate improvement and resultantly higher growth rates and better quality of tea leaves as well as better economic returns. Shade trees covering the tea plantation protect the crop from direct sunlight, scorching heat and warm air currents. As a result, the air temperature at the surface of the tea leaves is minimized and the exchange of gas between the tea leaves and its environment is unhindered. This favorable condition enhances absorption and translocation of water and plant nutrients from the soil to the

various parts of tea plant for adequate synthesis of plant phytochemicals including catechins and its derivatives. The observed increase in phenolic compounds in the study is in consonance with the report of Zhang et al., (2022) in which tea grown under shade had higher total phenols (17.27%) compared with tea grown in the open (14.92%)

Conclusion and recommendation

Intercropping tea with eucalyptus imparted soil nutrient status positively. The increased soil organic matter through litter fall and created enabling environment for microbial activities in the soil which made decomposition and mineralization of organic material easy leading to increased build up of macro and micronutrients in the studied tea-intercropped farms compared with mono-cropped tea farms. Intercrop of tea with eucalyptus also enhanced the synthesis of polyphenolic and bioactive compounds in tea leaves.

As good as the outcome of the study is, the possibility of competition for nutrients and water between tea and eucalyptus it has to be borne in mind. In a situation where eucalyptus density within the tea farm becomes higher than necessary, the shade from canopy cover will prevent sunlight from reaching the tea plant and photosynthesis will be hampered. The unnecessary shade cover could also encourage the emergence of diverse pathogenic organisms due to the moistly environment.

It is therefore recommended that, intercrop of tea with eucalyptus be done in such a way that adequate aeration, sunlight and water supply is not hindered.

Table 1: Chemical properties of soil under tea-eucalyptus intercrop and mono-cropped tea farms

Parameters	Kusuku			Kakara			Sabongari		
	Open	Under Eu	% Inc	Open	Under Eu	% Inc	Open	Under Eu	% Inc
pH	4.80	5.02	4.6	4.68	4.92	5.12	4.77	4.85	1.67
Available P ($mgkg^{-1}$)	9.50	9.94	4.6	10.90	11.20	3.00	9.55	9.76	2.19
Na ($cmolkg^{-1}$)	0.32	0.33	3.0	0.22	0.23	4.50	0.31	0.33	6.45
K ($cmolkg^{-1}$)	0.34	0.37	9.0	0.21	0.23	9.50	0.11	0.12	9.0
Ca ($cmolkg^{-1}$)	1.29	1.51	17.0	0.75	0.82	9.30	0.99	1.06	7.0
Mg ($cmolkg^{-1}$)	1.27	1.40	10.24	0.40	0.44	10.00	0.66	0.72	9.0
Exc. Acidity	0.26	0.27	3.84	0.16	0.17	6.25	0.14	0.15	7.14
N (%)	0.28	0.46	64.0	0.19	0.22	16.00	0.22	0.30	36.0
Organic Carbon (%)	4.40	5.40	23.0	4.24	4.63	9.00	4.56	4.98	9.2
Cu ($mgkg^{-1}$)	0.89	1.00	12.0	1.05	1.12	7.00	0.60	0.62	3.0
Zn ($mgkg^{-1}$)	2.87	3.65	27.0	5.45	5.73	5.00	9.78	9.85	1.32
Mn ($mgkg^{-1}$)	13.45	15.28	13.0	2.45	2.64	7.80	5.45	6.30	15.0
Fe ($mgkg^{-1}$)	13.93	13.93	-	39.15	39.18	0.10	26.00	26.83	3.19

Key: Euc – Eucalyptus; % Inc - % increase in parameters; Open – Open field/Mono-cropped

Table 2: Biochemical parameters of green tea from tea-eucalyptus intercrop and mono-cropped tea farms

	Kusuku			Kakara			Sabongari		
Parameters (mg/100g)	Open	Under Eu	% Inc	Open	Under Eu	% Inc	Open	Under Eu	% Inc
Total phenol	9593	9756	1.70	8753	8844	1.04	8618	8761	1.67
Catechin	57.12	57.76	1.12	50.80	51.12	0.63	47.84	48.48	1.33
Caffeine	3320	3500	5.42	3240	3410	5.26	3112	3218	3.40
Gallic acid (GA)	2464	2637	7.00	2389	2441	2.17	2450	2531	3.31
Epicatechin (EC)	813	915	12.6	567	673	18.70	600	684	13.91
Epigallocatechin (EGC)	2055	2200	7.00	1980	2099	6.00	1901	1986	4.47
Epigallocatechin gallate (EGCG)	7120	8567	20.31	6453	7288	12.93	6842	7899	15.44
Epicatechin gallate(ECG)	1490	1654	11.00	1383	1506	9.00	1368	1484	8.48
Catechin gallate (CG)	7	7.14	2.00	6.50	6.62	1.85	6.20	6.32	1.94
Gallocatechin (GC)	250	265	6.00	241	253	5.00	236	247	4.66

Key: Euc – Eucalyptus; % Inc - % increase in parameters; Open – Open field/Mono-cropped

REFERENCES

Astar, S., Abdeen, S., Dashti, H., Khoursheed, M., Al-Sayeer, H., Matthew, T. and Al-Bader, A. (2003). Effect of green tea in the prevention of and reversal of fasting induced intestinal mucosal damage. Journal of Nutrition, 19(6), 536-540

Bray, R.H. and Kurtz, L.T. (1945). Determination of total, organic and available forms of phosphorus in soils.Soil Sci. 59:39-45

Bremner, J.M. (1996). Nitrogen total. In Methods of soil analysis, Part 3: Chemical Methods; Sparks, D.L. (ed); Soil Science Society of America: Madison, Wisconsin, 1085-1121

Cabrela, C., Gimenez, R. and Lopez, C. M. (2003). Determination of tea components with anti-oxidant activity. Journal of Agriculture and Food Chemistry, 51, 44274435.

Karori, S. M., Ngure, R. M., Wachira, F. N, Wanyoko, J. K and Mwangi, J. N. (2008). Different types of tea products attenuate inflammation induced in trypanosome brucei infected mice. Parasitology International, 57, 325-333.

Karori, S. M., Wachira F. N., Wanyoko, J. K., and Ngure, R. M. (2007). Antioxidant capacity of different types of tea products. African Journal of Biotechnology, 6, 228

Liu Z. and Balasubramanian (2012) Hydrothermal carbonization of waste biomass for energy generation. Procedia Environmental Sciences 16:159-166

Mehlich, A. (1984).A modification of the Mehlich 2 extractant. Communications in Soil Science and Plant Analysis 15:1409-1416

Paudel B., R.P. Udawata, R.J. Kremerand S.H. Anderson (2011) Soil quality indicator responses to row crop, grazed pasture and agroforestry buffer management. Agroforestry system 82:311-323

Pourmorad, F., Husseini Mehr, S. J. and Shahabimajd, N. (2006). Antioxidant, phenol and flavanoid contents of some selected Iranian medicinal plants. African Journal of Biotechnology, 5, 1142-1145.

Qianwen Zhang O., Bi, G., Li T., Wang Q., Xing Z., (2022) Color shade nets affect plant growth and seasonal leaf quality of Camellia sinensis grown in Mississippi, the United State. Frontiers in Nutrition 6:1-12

Sabu, M. C., Smitha, K. and Kuttan, R. (2002). Antidiabetic activity of green tea polyphenols and their role in reducing oxidative stress in experimental diabetes. Journal of Ethnopharmacology, 83, 109-116

Sarkar, U.K, Saha, B.K, Goswani, C and Chowdhury, M.A.H (2010).Leaf litter amendment in forest soil and their effect on the yield quality of red amaranth. J. Bangladesh. Agril. Univ. 8(2):221-226

Schollenberger, C.J. and Simeon, L.A. (1945). Multipurpose extractant for Na, K, Ca, Mg. Soil Sci. 45:12

Stewart, J. A., Mullen, W and Crozier, A. (2004). On line high performance liquid chromatography of the antioxidant phenolics in green and black tea. Molecular Nutrition Food Research, 49, 52-60.

Walkey, A. and Black, I.A. (1934). Methods of soil analysis. Sci, 37: 29-38.

Wu, C. D and Wei, G. X (2002). Tea as a functional food for oral health. Journal of Nutrition, 18, 443-444

Young, A.. (1989) Agroforestry for soil conservation. 1st edition Oxford University Press.

RESEARCH REPORT

Year: 2021

Research Programme: Tea

Title: Comparative Study of Tea Marketing in Kano and Benue State of Nigeria

List of Investigators: Yahaya, A.T; Oluyole, K.A and Oladokun, Y.O.M

Introduction: Tea has become the world's first most popular beverages after water, it is the cheapest beverage in the world and consumed by over 3 million people across religion and culture. It represents one of the major components of world's beverage market (IISD, 2019; UNCTAD, 2016, Anderson, 2014). It is a commodity of high value with extensive value addition capacity for economics of scale (IISD, 2019; Blue print, 2017). Tea has contributed largely to the Gross Domestic Product (GDP) and Gross National product (GNP) of growing countries and has growing international market in health and food industries. The demand for tea is increasing and continued to increase across the world (Ethical Tea partnership, 2019; Solidaridad Network, 2014).

Global Tea sales (7.76 billon tons in 2018) recorded a good performance attributed largely to urban population growth (UNCOMTRADE, 2020). Tea sector is projected to experience continued and increasing growth due to increasing demand primarily from Asian and Pacific countries. Increase demand for tea is attributed to increasing income, growing clientele among young urban consumers, interest in the health benefit of drinking tea, expansion of new products and flavouring such as ready-to- drink /instant tea, premium tea, herbal and fruit fusion (Bolton, 2019, Kumar, 2019, FAO, 2018, Mordor, 2018 and Zion, 2018, Technavo, 2017).

Nigeria is one of Tea producing countries in the World; Nigeria, tea production was estimated at an average 82,234 tons per year (NBPC, 2011) and it increased to 167,324 metric tons in 2018, an average consumption level of 100kg/ person/ year (NBPC, 2019, Oluyole, et al, 2017). Tea production in Nigeria is a significant economic activity; approximately 10,000 people depend on Tea as source of livelihoods. In Nigeria Tea is a source of raw materials for industry producing value added products in many parts of the country and is a vital part of beverages market in Nigeria (CRIN annual reports, Oluyole et al, 2018**)**.
Consumption of tea is done across religion and culture in Nigeria but predominantly in the Northern part (CRIN annual reports, CRIN @ 50).

Objective
The study assessed marketing activities in tea across three LGA's each, in Kano and Benue states of Nigeria vis-a-vis:

1. the market outlook and volume of tea trade in each region for comparative advantage and competitiveness of tea trade in Nigeria.
2. determine the opportunities for business relationship for small- holders' farmers and processors
3. analyze the constraints to tea marketing in these region
4. examine the various stages and actors in tea marketing in Nigeria.
5. provide a policy recommendation for tea crop as a good source of revenue for Nigerian economy.

Materials & Methods:

The study was carried out in Otkupo, Gboko & Markudi LGA's, in Benue and Fagge LGA of Kano states respectively. Multistage sampling techniques was used to select Otkupopo, Main

and Nwukuru markets of Benue and Singa market of Kano State respectively. The second stage was selection of respondent for the study. The third stage was selection of 241 respondents from the selected markets. Information was collected with the use of structured questionnaire, which seeks information on cost incurred on inputs and output, volume of sales, prices of inputs and output, supply chain, sources of materials for sales, buyers, channel of marketing, levels paid to government at different levels, subsidy received from government, constraint to marketing among others. Data were analysed with the use of descriptive statistic and Policy Analysis Matrix (PAM). The indicator of competitiveness in PAM was employed.

Results and Discussion:

The results of the social-economic characteristics of the respondents were presented in Table 1. The result showed that in Kano, 65.56% of the respondents are between 40-50 years. There is a positive correlation between age and efficiency. Youth are more meticulous in carrying out their activities and they easily embrace new technology. However, the result show that in Benue, 67.22% of the respondents are between 40-50 years. This indicates that the marketers are in their active and productive age. It is also observed that in Kano, larger percentages (96.27%) of men are into tea marketing. Males are more involved in buying and selling, while their female counterparts are into managing family activities owing to religious reasons. On the other hand, more females (69.98%) are into tea marketing in Benue along sides their male counterpart (34.02%). This indicate that both male and female are actively involved in tea marketing in Benue. Results for Kano shows that majority of the respondent (70.54%) had no education at all while (23.65%) had only basic education. This informed their method of business dealings in the areas. Nevertheless, (85.89%) of the respondent in Benue had secondary school education and (5.81%) had primary education, while (8.30%) of them had no education at all. This informs efficiency in their business dealings in the areas.

Table 2 show the cost and returns of tea marketing in the study areas using the policy analysis (PAM). The estimated private budget for tea marketing in Kano and Benue states are presented respectively. Table 1 showed that in Kano state, the estimated total cost incurred was ₦ 7,010 per ton. The component of the cost includes input cost of (Generator cost, building cost, Vehicle cost), factor cost (such as cost of rentage, transportation cost, electricity cost, cost of fueling, interest on loan) as well as labour cost. The estimated input cost was ₦ 273,284. The value of factor cost was ₦383,488 while that of labour cost was ₦500,000 at private cost. The estimated revenue per ton was ₦185,588.88 per ton at private prices, hence, a net profit of ₦ 178,578.88 per ton was derived at private prices.

Table 2 also showed that in Benue state, the estimated total cost incurred was ₦ 5,295 per ton. The component of the cost includes input cost of (Generator cost, building cost, Vehicle cost), factor cost (such as cost of rentage, transportation cost, electricity cost, cost of fueling, interest on loan) as well as labour cost. The estimated input cost was ₦ 150,000. The value of factor cost was ₦220,000 while that of labour cost was ₦689,188 at private cost. The estimated revenue per ton was ₦ 3,553,031 per ton at private prices, hence, a net profit of ₦ 3,547,736 per ton was derived at private prices.

Table 3 shows the supply chain of tea in the study areas. It shows the sources of tea market open to traders dealing in tea in Kano and Benue states respectively. From the table, high percentage (85.89) of the marketer in Kano source their materials for sales from the packagers while (55.19) marketer in Benue source theirs from processors. Its however worthy of note that marketers in the study areas do not have access to business relationship with tea farmers.

Table 4 shows the buyers of tea from marketers in Kano and Benue state respectively. The table shows that in Kano majority (41.49) of tea marketers sell their good to countries like Niger Republic, Chad, Cameroun. This is unique features of tea marketing in these areas. Also, the table also shows that 36.10 percent of marketers sell their products directly to the consumers. However, in Benue, majority of marketer sell to retailers while 37.34 are sold to consumer.

Table 5 shows the constraints to tea marketing in Kano and Benue states respectively. The table shows that major problems to tea sales in Kano and Benue states respectively are not getting sufficient tea for sales and insecurity in the land. The table shows that in Kano 65.98 marketers complain they do not have enough tea to sell while 20.75 claimed insecurity constitute another major problem to the marketing activities. Similarly, in Benue state, majority 37.34 also complain of lack of enough tea materials for sales. Tea marketing in Benue is also affected by insecurity as 29.46 percent of the marketer's complaint. This is an indication of marketing opportunities for small holders' farmers and processors in Mambilla, Taraba States who complains of lack of markets to sell to.

Table1. Social Economic Characteristic of the respondents

Variable	Kano		Benue	
Age	Freq.	Percent	Freq.	Percent
≤ 40	13	5.39	57	23.62
40-50	158	65.56	162	67.22
51-60	68	28.22	19	7.88
>60	2	0.83	3	1.24
Total	241	100.00	241	100.00
Gender				
Male	232	96.27	82	34.02
Female	9	3.73	159	65.98
Total	241	100.00	241	100.00
Educational Status				
No Education	170	70.54	20	8.30
Primary Education	57	23.65	14	5.81
Secondary Education	14	5.81	207	85.89
Total	241	100.00	241	100.00

Source: Field Survey 2021

Table 2. Estimated Budget for Tea Marketing in Kano and Benue state

Variable	Kano	Benue

	price (₦)	price(₦)
Tradable inputs	273,284	150,000
Domestic factors	383,488	220,000
Labour	500,000	689,188
Total cost	1,156,772	1,059,188
Cost/ton	7,010	5,295
Revenue/ton	185,588.88	3,553,031
Profit/ton	178,578.88	3,547,736

Field Survey, 2022

Table 3. Source of material for sales

	Kano		Benue	
	Freq	Percentages	Freq	Percentages
Farmers	0	0	0	0
Processors	34	14.11	133	55.19
Packagers	207	85.89	108	44.81
Total	241	100	241	100

Field Survey, 2022

Table 4. Marketing and sales

	Kano		Benue	
	Freq	Percentages	Freq	Percentages
Consumers	87	36.10	90	37.34
Retailers	34	14.11	139	57.68
Distributors	20	8.30	12	4.98

Export	100	41.49	0	0
Total	241	100	241	100

Field Survey, 2022

Table 5. Constraint to Marketing

		Kano		Benue	
		Freq.	Percent	Freq.	Percent
i.	High Tax	0	0	50	20.75
ii.	High Prices inputs	2	0.83	10	4.15
iii.	Non-Availability of Tea for sales	159	65.98	90	37.34
iv.	Proximity to source of raw materials	5	2.07	0	0
v.	Storage Facilities	0	0	0	0
vi.	Credit Accessibility	25	10.37	20	8.30
vii.	No- support from Govt.	0	0	0	0
viii.	Non-Existence of Tea Policy	0	0	0	0
ix.	Insecurity	50	20.75	71	29.46
	Total	241	100	241	100

Field Survey, 2022

Conclusion and Recommendations: Tea marketing is done majorly by youths in their active working years in the study areas. Tea sales is competitive given the net profit derived by marketers in the study areas. The supply chain of tea in the areas is such that tea are sourced from packagers and processors who sell to marketers who in turns sell to consumers, retailers or sell to neighboring countries. Major problems to marketing in the study areas area inability to get enough tea materials for sales and insecurity. This study thereby recommends a link between small- holders' farmers and cottage processors in Mambilla Taraba state who yearn for market to sell their produce to improve their livelihoods.

References:

Oluyole K.A, Yahaya AT Agbebaku EO (2017). Competiteness of tea production and challenges to tea value chain in Taraba state, Nigeria. Journal of Innovative Agriculture, Vol 4 (1), 10-16.

Aina L.O (2006). Information provision to farmers in Africa: The libraray-extension services linkage World library and information council, Seoul, Korea.

2021 RESEARCH REPORT

RESEARCH PROGRAMME: **Tea**

Title: Development and characterization of health friendly flavored green tea blends

Investigators: Yahaya L.E, Okunade A.F, Ajewole A.O, Jayeola C.O, Olorundare B, and Igbinadolor R.O

Introduction: Tea (*Camellia sinensis* L) is one of the most widely popular non alcoholic beverage, consumed by over two thirds of the world's population due to its medicinal, refreshing and mild stimulating effects. There are four main types of made tea used for tea infusion based on their respective processing methods. These includes black or red, oolong, green and white. Green tea remains one of the most favorite choice of beverage among tea drinkers across the globe. This is occasioned by its associated health benefits accruable from it. It is made of pan-fired leaves having high amount of epigallocatechin Gallate (EGCG). The principal catechins present in green tea such as (-)- epicatechin (EC), (-)-epigallocatechin (EGC), (-)-epicatechin - 3-gallate (ECG), (-)-epigallocatechin-3-gallate (EGCG) and (-)-gallocatechin gallate (GCG) are indicated as major part of biologically active substances (Ho et al., 1994; Sharma et al., 2014). EGCG is the most common polyphenol found in green tea and represents up to 10% of its dry weight and includes 60-70% of its total catechins. Many of the green tea has health promotion abilities that are attributed to EGCG (Patil et al., 2016). Value addition remains one way to diversify product. According to (Herath and De Silva, 2011), value addition of tea can be achieved through product differentiation such as spicing. Spicing of tea is one way of product differentiation and brand development. Spices are mainly used for flavoring and they also have certain medicinal properties. A spice consists of a dried seed, fruit, root, bark or vegetative substance used in nutritionally little quantities as a food additive for flavor, color, or as a preservative that is inimical to harmful bacteria or prevents their growth. So, addition of these spices with tea can play an important role in public health and can be used for medicinal purposes. Cinnamon contains unique healthy and healing property due to the presence of active components. Naturally, green tea taste is bitter, hence might not appeal to many; however, spicing can help resolve this challenge. This paper therefore reports the development and characterization of spiced green tea.

Materials and Method: *Green Tea Processing:* A bud and two leaves were obtained from the plant *Camellia sinensis*. The leaves were subjected to withering after which it was pan-fired and then rolled. The rolled tea leaves were then dried in an oven. Spice (cinnamon) used for this work was obtained from the open market. The processed tea leaves were pulverized and blending was carried out.

Preparation of spice green tea. The spice (cinnamon) was added to green tea in powder form and green tea without spice as control sample were used for this study. Blending was done on a weight to weight ratio (w/w) (0, 10, 20, 30, 40, 50%) of spice to processed teas. Proximate characteristics of Green Tea blend were carried out according to standard methods, mineral and antioxidant profile were also carried out.

Results and Discussion: The proximate composition of the tea blend is presented in Table 1. It is obvious that moisture content was maximum at 10% inclusion of spice while the least was obtained at 50%. On the other hand, highest value of 14.9% was recorded for tea blend of 40% inclusion for crude fibre. There was a general decrease in total ash with increase inclusion of spice. This may be as a result of the inherent high content of the additive. Caffeine content increased with increasing spice inclusion while water extract and ether extract assumed irregular pattern in the course of the study.

Table 2 shows the antioxidant profile of the tea blend. Free radical scavenging activity (DPPH), Ferric reducing antioxidant power (FRAP)and total polyphenols values indicates that inclusion of spice in green tea further enhances the antioxidant capacity of the product and could therefore scavenge free radicals in the body. The sensory property results (table not shown) also indicates that 20% inclusion of the spice was the preferred and accepted level of inclusion for tasters.

Table 1. Proximate characteristics of Green Tea blend

Sample Code	Moisture Content(%)	Crude Fibre (%)	T. Ash (%)	Protein (%)	Ether extract (%)	Water extract (%)	Catechin (%)	Caffeine (%)
A	7.26	13.62	15.88	6.41	43.41	2.15	4.88	7.36
B	7.41	13.81	12.12	6.72	41.01	2.61	3.74	7.41
C	7.38	13.89	11.66	7.69	40.39	2.83	3.28	7.69
D	7.33	14.22	11.29	7.81	40.11	3.11	3.54	7.93
E	7.14	14.92	10.51	8.84	39.68	3.42	3.18	8.01
F	7.09	13.71	10.05	8.99	39.09	3.44	3.21	7.91

Table 2. Antioxidant profile of Green Tea blend

Samples code	DPPH (%)	FRAP (Mm $FeSO_4$/100g)	Total phenolics (%)
A	86.9	0.45	18.19
B	86.6	0.26	18.00
C	86.2	0.24	17.83
D	85.7	0.19	17.71
E	84.4	0.13	17.24
F	83.6	0.13	17.37

Conclusion and Recommendation: The study shows that blending green tea with spice can add to its nutritional status as well as health benefit. Organoleptic assessment revealed that 20% inclusion remained the best choice for taster. It can therefore be recommended that green tea should be spiced to help increase its health benefit to its consumers.

References

1.Herath, H., & De Silva, S. (2011). Strategies for Competitive Advantage in Value Added Tea Marketing. Tropical Agricultural Research, 22(3), 251–262.

2.Ochanda, S. O., Wanyoko, J. K., Kamau, D. M., Kamunya, S. M., Faraj, A. K., & Onyango, C. (2011). The effect of selected spices on un-aerated tea product from clone TRFK 303/57. Tea Journal, 32(2), 88–99.

3.Ruto, H. K., Moseti, K. O., Koech, R. K., & Wanyoko, J. K. (2014). Methods developed for the analysis of major biochemical compounds found in tea: A review. In 1st International Confrence Maasai Mara University, 11-14.

4.Ho CT, Ferraro T, Chen Q, Rosen RT, Huang MT. Phytochemicals in teas and rosemary and their cancerpreventive properties, 1994.

5.Sharma M, Nagori K, Soni S, Swarnakar H, Vaishnav S, Khan N. Phytochemical constituents and pharmacological profile of green tea: an overview. International Journal of Pharmaceutical and Chemical. 2014; 3:110-117.

6.Patil MP, Patil KT, Ngabire D, Seo YB, Kim GD. Phytochemical, antioxidant and antibacterial activity of black tea (Camellia sinensis). International Journal of Pharmacognosy and Phytochemical Research. 2016; 8(2):341-346.

7.Senanayake SN. Green tea extract: Chemistry, antioxidant properties and food applications–A review. Journal of Functional Foods. 2013; 5(4):1529- 1541.

8.Singleton VL, Rossi JA (1965) Colorimetry of total polyphenolic with phosphomolybdic—phosphotungstic acid reagents. Am J Ecol Vitic 16:144–158

2021 RESEARCH REPORT

RESEARCH PROGRAMME: Tea

Title: Adsorption of heavy metals ions using spent tea leaves and its derivatives

Investigators: Yahaya L.E, Odeyemi E. F, Osikoya T, Olalekan-Adeniran M.A, Atanda J.

Introduction: The increasing rate of industrialization often generate heavy metal load into the environment and this has constituted serious threat to plant and animal lives today. Among these heavy metals is lead, a toxic metal commonly found in industrial workplaces. These contaminations are derived from various activities such as mining of ores, tanneries,

electroplating, vehicular movements as well as petrochemical refineries. Heavy metal contamination to the environment even at low concentration can be toxic (Ahluwalia, S. and D. Goyal, 2005). Different methods exist for the treatment of metal ions from aqueous solutions and this include chemical and surface chemistry processes such as precipitation, adsorption, membrane processes, ionic exchange, floatation, electrochemical coagulation chelation etc (Mittal et al, 2005; Muruganandham and Swaminathan, 2006). However, these techniques have their own drawbacks such as less efficiency, sensitive operating conditions, and production of secondary sludge requiring further costly disposal [Fil et al, 2012]. These setback, coupled with the need for more economical and efficient methods for recovery of heavy metals from wastewater have resulted in the development of alternative separation technologies. The tea industry generates a large volume of spent tea leaves, STL, which has not been adequately harnessed into in tea plantations. This study was thus aimed at exploiting opportunities for agricultural waste management.

Materials and Method: The batch adsorption experiments were carried out on the removal of two heavy metal ions (Pb (II) and Zn (II) from aqueous solution to study the kinetics, mechanisms, and thermodynamics properties. In the kinetic experiments, the batch adsorption studies were carried out by shaking 0.5 g of the spent tea leaves (STL) with 25 mL of different concentrations (10 – 100 mg/L) at varying pH (1-8) containing the metal ions for various contact times (10 -180 min) over a range of temperature. The influence of pH on the sorption behavior of the metal ions was carried out within the range that would not be influenced by metal precipitated. The initial pH of each solution was thus adjusted to the desired pH by drop wise addition of 0.1M HNO_3 and/or 0.1M NaOH solution. At the end of each contact time, the mixture was filtered and the residual concentration was determined using Atomic spectrophotometer, AAS (Buck scientific model 210 VGP). The amount of Pb (II) and Zn (II) removed from solution by STL was taken as the difference between initial and residual concentrations of the metal ion. All the experiments were carried out in triplicates and the mean value taken. Percentage removal of the metal ions was estimated using the following equation:

$$\text{Removal efficiency} = Ci- C_f/C_i \times 100 \quad (1)$$

where, Ci : Concentration of heavy metal ions before adsorption C_f : Concentration of heavy metal ions after adsorption The amount of metal ion adsorbed at time t (qt) was calculated using the formula:

$$qt = (Ci- C_f)v/m \quad (2)$$

where, v: volume of aqueous solution used for adsorption m: mass of adsorbent used.
Kinetic and thermodynamic studies were carried out using spent tea leaves.

Results and Discussion: The effect of contact time on adsorption by spent tea leaves (STL) indicates that 30 minutes was required for the metal ions to achieve optimum adsorption. For Pb (II), it required 30 minutes to remove 95% of the ion from aqueous solution while it took the same time period to remove 97.5 % Zn (II) from aqueous solution. From the plot, it can be seen that metal ion uptake increases with contact time for the adsorbent, however, adsorption of both ions tends to decrease after 30 minutes, and no significant increase was

observed even after 180 minutes contact period. It is clear that STL can adsorb an appreciable amount of these ions within a short period.

It is well known that the adsorption of metal ions by adsorbents is pH dependent. Metal ion adsorption on the surface of an adsorbent is described in terms of molecular mechanisms, which may probably include cation exchange in the interlayer and specific adsorption that results from surface complexation. Metal ion complexation is affected by hydrogen ions because of the affinity they have for the adsorption sites. The effect of initial pH on the adsorption of Pb and Zn ions by STL was studied and the result shown in Figure 2. From the figure, it is observed that there was an increase in the adsorption of the heavy metal ions with increase in pH from 1- 4, where maximum adsorption of 87% was recorded for Zn and 1-5 and with maximum adsorption of 96% for Zn (II) and Pb (II) respectively. STL contains functional groups that are favorably disposed to Pb (II) and Zn (II) ion. As the pH of the solution increased, these functional groups are exposed thereby favoring the attraction of the metal ions with positive charge, hence the increased adsorption. At this pH, the surface charge on the adsorbents increases, thereby enhancing the physical adsorption on the functional groups.

Heavy metal ions adsorption is also a function of the quantity of adsorbent available for adsorption. Figure 3 shows the effect of adsorbent dose on the percentage removal of Pb (II) and Zn (II) ion onto Spent Tea leaves. It is observed that percentage removal of metal ion increased with increase in adsorbent weight between 0.25 and 0.5 g for both metal ions. The optimal level of Pb and Zn ions removal by STL is thus established at 0.5 g. It was noted that a higher percentage of the Zn (II) was removed at this dosage than for Pb (II). The observed difference in the level of adsorption may be explained based on the difference in ionic radii of the two metals. Adsorption of heavy metals having smaller ionic radius has been reported to be superior. The kinetics and thermodynamic results are not shown in this report but subsequent one.

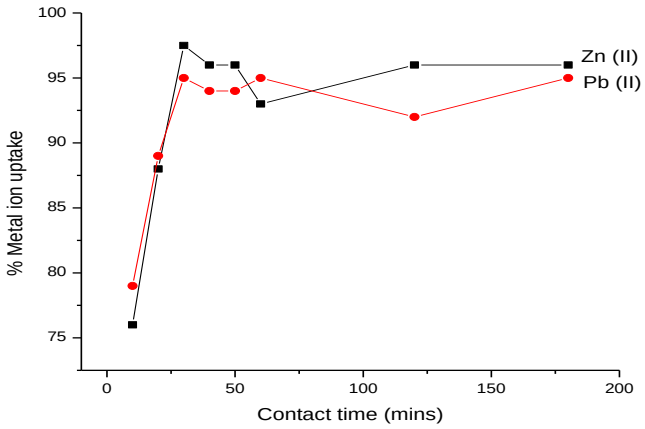


Figure 1. Change in contact time on the adsorption of Pb^{2+} and Zn^{2+} by STL

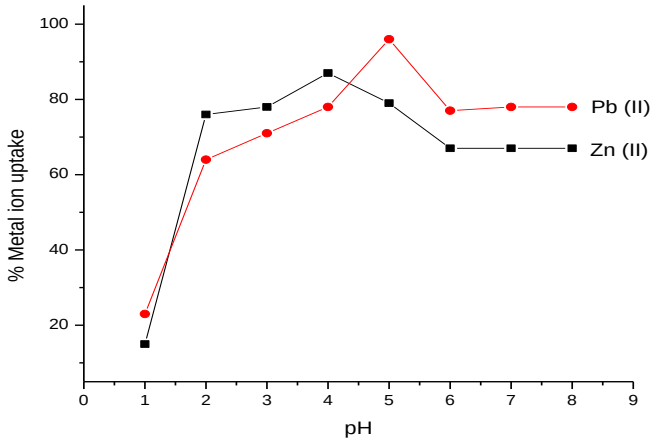


Figure 2. Effect of pH on the adsorption of Pb (II) and Zn (II) ion onto STL

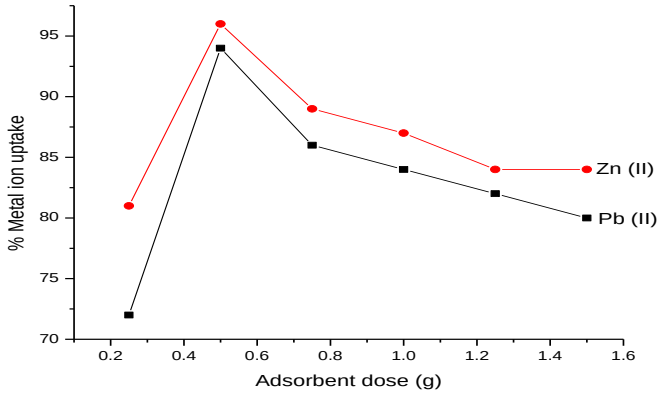


Figure 3. Changes in adsorbent dose on the uptake of Pb (II) and Zn (II) by STL

Conclusion and Recommendation: These results indicate that spent tea leaves can be used as a low cost adsorbent in scavenging heavy metal ions such as Pb (II) and Zn (II) from solutions containing same. It will be recommended that large scale production of the adsorbent be produced and a collaboration with industrial stakeholders be encouraged.

References:

Mittal, A., L. Kurup and V.K. Gupta, 2005. Use of waste materials—bottom ash and de-oiled soya, as potential adsorbents for the removal of Amaranth from aqueous solutions. Journal of Hazardous Materials, 117(2): 171-178.

Muruganandham, M. and M. Swaminathan, 2006. Photocatalytic decolourisation and degradation of reactive orange 4 by TiO2- UV process. Dyes and Pigments, 68(2): 133-142.

Yang, C.L. and J. McGarrahan, 2005. Electrochemical coagulation for textile effluent decolorization. Journal of Hazardous Materials, 127(1): 40-47. 7. Ahluwalia, S. and D. Goyal, 2005. Remo

Fil, B.A., R. Boncukcuoglu, A.E. Yilmaz and S. Bayar, 2012. Adsorption kinetics and isotherms for the removal of zinc ions from aqueous solutions by an ion-exchange resin. J. Chem. Soc. Pak, 34(4): 841.

Rorrer, G.L., Removal of heavy metal ions from wastewaters. In: Encyclopedia of Environmental analysis and remediation. Vol. 4. 1998 NY: John wiley and sons. 2102-2125.

Ahluwalia, S. and D. Goyal, 2005. Removal of heavy metals by waste tea leaves from aqueous solution. Engineering in life Sciences, 5(2): 158-162.

Brinza, L., M.J. Dring and M. Gavrilescu, 2007. Marine microand macro-algal species as biosorbents for heavy metals. Environmental Engineering and Management Journal, 6(3): 237-

RESEARCH REPORT

Year: 2021

Research Programme: Tea

Title: Comparative Study of Tea Marketing in Kano and Benue State of Nigeria

List of Investigators: Yahaya, A.T; Oluyole, K.A and Oladokun, Y.O.M

Introduction: Tea has become the world's first most popular beverages after water, it is the cheapest beverage in the world and consumed by over 3 million people across religion and culture. It represents one of the major components of world's beverage market (IISD, 2019; UNCTAD, 2016, Anderson, 2014). It is a commodity of high value with extensive value addition capacity for economics of scale (IISD, 2019; Blue print, 2017). Tea has contributed largely to the Gross Domestic Product (GDP) and Gross National product (GNP) of growing countries and has growing international market in health and food industries. The demand for tea is increasing and continued to increase across the world (Ethical Tea partnership, 2019; Solidaridad Network, 2014).

Global Tea sales (7.76 billon tons in 2018) recorded a good performance attributed largely to urban population growth (UNCOMTRADE, 2020). Tea sector is projected to experience continued and increasing growth due to increasing demand primarily from Asian and Pacific countries. Increase demand for tea is attributed to increasing income, growing clientele among young urban consumers, interest in the health benefit of drinking tea, expansion of new products and flavouring such as ready-to- drink /instant tea, premium tea, herbal and fruit fusion (Bolton, 2019, Kumar, 2019, FAO, 2018, Mordor, 2018 and Zion, 2018, Technavo, 2017).

Nigeria is one of Tea producing countries in the World; Nigeria, tea production was estimated at an average 82,234 tons per year (NBPC, 2011) and it increased to 167,324 metric tons in 2018, an average consumption level of 100kg/ person/ year (NBPC, 2019, Oluyole, et al, 2017). Tea production in Nigeria is a significant economic activity; approximately 10,000 people depend on Tea as source of livelihoods. In Nigeria Tea is a source of raw materials for industry producing value

added products in many parts of the country and is a vital part of beverages market in Nigeria (CRIN annual reports, Oluyole et al, 2018).

Consumption of tea is done across religion and culture in Nigeria but predominantly in the Northern part (CRIN annual reports, CRIN @ 50).

Objective

The study assessed marketing activities in tea across three LGA's each, in Kano and Benue states of Nigeria vis-a-vis: the market outlook and volume of tea trade in each region for comparative advantage and competitiveness of tea trade in Nigeria determine the opportunities for business relationship for small- holders' farmers and processors analyze the constraints to tea marketing in these region examine the various stages and actors in tea marketing in Nigeria provide a policy recommendation for tea crop as a good source of revenue for Nigerian economy.

Materials & Methods:

The study was carried out in Otkupo, Gboko & Markudi LGA's, in Benue and Fagge LGA of Kano states respectively. Multistage sampling techniques was used to select Otkupopo, Main and Nwukuru markets of Benue and Singa market of Kano State respectively. The second stage was selection of respondent for the study. The third stage was selection of 241 respondents from the selected markets. Information was collected with the use of structured questionnaire, which seeks information on cost incurred on inputs and output, volume of sales, prices of inputs and output, supply chain, sources of materials for sales, buyers, channel of marketing, levels paid to government at different levels, subsidy received from government, constraint to marketing among others. Data were analysed with the use of descriptive statistic and Policy Analysis Matrix (PAM). The indicator of competitiveness in PAM was employed.

Results and Discussion:

The results of the social-economic characteristics of the respondents were presented in Table 1. The result showed that in Kano, 65.56% of the respondents are between 40-50 years. There is a positive correlation between age and efficiency. Youth are more meticulous in carrying out their activities and they easily embrace new technology. However, the result show that in Benue, 67.22% of the respondents are between 40-50 years. This indicates that the marketers are in their active and productive age. It is also observed that in Kano, larger percentages (96.27%) of men are into tea marketing. Males are more involved in buying and selling, while their female counterparts are into managing family activities owing to religious reasons. On the other hand, more females (69.98%) are into tea marketing in Benue along sides their male counterpart (34.02%). This indicate that both male and female are actively involved in tea marketing in Benue. Results for Kano shows that majority of the respondent (70.54%) had no education at all while (23.65%) had only basic education. This informed their method of business dealings in the areas. Nevertheless, (85.89%) of the respondent in Benue had secondary school education and (5.81%) had primary education, while (8.30%) of them had no education at all. This informs efficiency in their business dealings in the areas.

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Table1. Social Economic Characteristic of the respondents

Variable	Kano		Benue	
Age	Freq.	percent	Freq.	Percent

≤ 40	13	5.39	57	23.62
40-50	158	65.56	162	67.22
51-60	68	28.22	19	7.88
>60	2	0.83	3	1.24
Total	241	100.00	241	100.00
Gender				
Male	232	96.27	82	34.02
Female	9	3.73	159	65.98
Total	241	100.00	241	100.00
Educational Status				
No Education	170	70.54	20	8.30
Primary Education	57	23.65	14	5.81
Secondary Education	14	5.81	207	85.89
Total	241	100.00	241	100.00

Source: Field Survey 2021

Table 2. Estimated Budget for Tea Marketing in Kano and Benue state

Variable	Kano price (₦)	Benue price(₦)
Tradable inputs	273,284	150,000
Domestic factors	383,488	220,000
Labour	500,000	689,188
Total cost	1,156,772	1,059,188
Cost/ton	7,010	5,295
Revenue/ton	185,588.88	3,553,031

Profit/ton	178,578.88	3,547,736

Field Survey, 2022

Table 3. Source of material for sales

	Kano		Benue	
	Freq	Percentages	Freq	Percentages
Farmers	0	0	0	0
Processors	34	14.11	133	55.19
Packagers	207	85.89	108	44.81
Total	241	100	241	100

Field Survey, 2022

Table 4. Marketing and sales

	Kano		Benue	
	Freq	Percentages	Freq	Percentages
Consumers	87	36.10	90	37.34
Retailers	34	14.11	139	57.68
Distributors	20	8.30	12	4.98
Export	100	41.49	0	0
Total	241	100	241	100

Field Survey, 2022

Table 5. Constraint to Marketing

	Kano		Benue	
	Freq.	Percent	Freq.	Percent
High Tax	0	0	50	20.75
High Prices inputs	2	0.83	10	4.15
Non-Availability of Tea for sales	159	65.98	90	37.34
Proximity to source of raw materials	5	2.07	0	0
Storage Facilities	0	0	0	0
Credit Accessibility	25	10.37	20	8.30
No- support from Govt.	0	0	0	0
Non-Existence of Tea Policy	0	0	0	0
Insecurity	50	20.75	71	29.46
Total	241	100	241	100

Field Survey, 2022

Conclusion and Recommendations: Tea marketing is done majorly by youths in their active working years in the study areas. Tea sales is competitive given the net profit derived by marketers in the study areas. The supply chain of tea in the areas is such that tea are sourced from packagers and processors who sell to marketers who in turns sell to consumers, retailers or sell to neighboring countries. Major problems to marketing in the study areas area inability to get enough tea materials for sales and insecurity. This study thereby recommends a link between small- holders' farmers and cottage processors in Mambilla Taraba state who yearn for market to sell their produce to improve their livelihoods.

References:

Oluyole K.A, Yahaya AT Agbebaku EO (2017). Competiteness of tea production and challenges to tea value chain in Taraba state, Nigeria. Journal of Innovative Agriculture, Vol 4 (1), 10-16.

Aina L.O (2006). Information provision to farmers in Africa: The libraray-extension services linkage World library and information council, Seoul, Korea.

Extension project

2021 Research Report

Cocoa Data Bank in Delta State, Nigeria

Oduwole, O.O., Oluyole, K.A., Akinpelu, A.O., and Orisasona, T.M.

Introduction

Nigeria is the World's fourth largest cocoa producer after Ivory Coast, Ghana and Indonesia, producing about 12 percent of the total world production. In Africa, Nigeria is the third producer (World Cocoa Foundation, 2014). Cote d'voire which was placed at a distant third position in Africa with 143,000 tonnes behind Nigeria's 196,000 tonnes in 1970 is now the largest producer of cocoa in the whole world with 12, 824, 717 tonnes while Nigeria with 298,029 tonnes is currently the fourth largest producer (FAO, 2019; ICCO, 2015). Nwachukwu *et al*. (2012) stated that cocoa is the most prominent export crop in Nigeria in terms of production and export capabilities. According to Adebile and Amusan (2011) cocoa contributes about 15 percent to the total Nigerian export in 1970 and also contributes $900 million to Nigeria's economy in 2012 (*The Sun*, 2013). Nigeria's cocoa production in 2011/12 was put at 300,000 MT, up from 280,000 MT in 2011. The increase is based on a favourable weather conditions in addition to considerably higher grower prices, which encouraged farmers to increase their farm holdings (David and Nzeka, 2011). Cocoa and its products exported from Nigeria include cocoa beans (whole or broken, raw or roasted), chocolate and other food preparations containing cocoa, cocoa paste (whether or not defatted) cocoa powder and cake and cocoa butter (World Cocoa Foundation, 2014). United States of America, Spain, France, Germany and Netherlands are the main importers of Nigerian cocoa. It was reported that Nigerian cocoa output declined from 399, 200 tonnes in 2010 to about 298, 029 tonnes in 2016 with a growth rate declining from 16.2% to about 12.2% during the period (FAO, 2019).

Objectives

The specific objectives of the study were to:

i. profile the socio economic characteristics of the farmers in the study area
ii. identify cropping patterns and agronomic practices among the farmers
iii. identify marketing channels in the study area
iv. identify constraints in cocoa production in the study area

Methodology

The study was carried out in Delta State, Nigeria in 2021. The study employed a multistage random sampling technique to select cocoa farmers. The first stage was a purposive selection of the state. This is because of the volume of cocoa production in the recorded in the state even though the production is marginal. The second stage was a random selection of two Local Government Areas within the state. These LGAs were randomly selected. The LGAs sampled for the study were Aniocha North Local Government Area and Ika North East Local

Government Area. The third stage was a random selection of 30 farmers each in Issele-Uku and Umunede communities, respectively. A total of sixty cocoa farmers within the two randomly selected LGAs were used formed the sample size for the study. Primary and secondary data were used for the study. Well structured questionnaire was used for the primary data. Data were collected on age of the farmers, marital status of farmers, household size, farming experience, educational level, and membership of farmers' association. Data was analyzed using simple descriptive statistics (means, frequencies, percentages).

Results and Discussion

Table 1 shows the socio-economic characteristics of cocoa farmers in Delta State. The table reveals that majority (86.67%) of the farmers were male. The implication of this is that cocoa farming in the study area is largely dominated by male gender. Girei *et al* (2013) reported that in Africa, men are more in a crop that is perceived to have commercial value. In addition, the result conforms to the findings by Taiwo *et al* (2015) who reported that about 68.7% of farmers that practiced cocoa rehabilitation techniques (CRTs) in Southwest and South-South agro-ecological zones of Nigeria are male. Similarly, the table reveals that majority (91.67%) of the farmers were married. Moreover, the mean age of the farmers is about 48 years with a Standard Deviation (SD) of ± 10.6. The implication of this is that cocoa farmers in the LGA are at the peak of their productive years and thus cocoa production in the study area is expected to be on the increasing trend. However, this is in not in consonance with the findings by Adeogun *et al* (2010) and Adebiyi and Okunlola (2013) who reported that cocoa farmers in selected states of Nigeria were old. Similarly, the table reveals that 45.00 percent of the farmers had access to primary education. The implication of this is that the farmers may perhaps have access to information on good agricultural practices (GAP) with respect to cocoa production. However, they may not be able to put thos GAP into use based on their level of education. Furthermore, the table reveals an average household size of 7 persons with 3.3 as SD. This implies that the farmers may perhaps utilize members of the household as labour for some operations relating to cocoa production. This may reduce some production and transaction costs expected to be incurred on the crop. Furthermore, the table shows that majority 88.35% of the cocoa farmers had between 1-5 hectares of cocoa farms. This implies that cocoa production in the study area is still in the hands of smallholder farmers who probably may not have access to farm inputs to enhance their productivity.

Table 2 below shows the distribution of the farmers according to cropping patterns, varieties of cocoa grown and sources of planting materials. The table reveals that majority of the farmers (91.67%) were involved in sole cocoa cultivation; about 68.33 percent of the farmers cultivated cocoa/arable crops combination. The implication of this is that sole cocoa cultivation is the most predominant cropping pattern in the study area. However, the result of cocoa/arable combination implies that the farmers maximized the use of available land intensification and crop diversification to guide against food insecurity. This conforms to a priori expectation. In addition, less than half (48.33%) of the farmers planted F3 Amazon variety of cocoa while 63.33 percent, 10.00 percent planted Amelonado and Hybrid (CRIN) varieties, respectively. This implies that distribution of CRIN varieties of cocoa has not spread enough to the farmers, hence the cultivation of the old and low yielding varieties. Furthermore, it was revealed that 31.67 percent, 30.00 percent 28.00 percent and 11.00 percent of the farmers got their planting materials from own farms, inherited, Ministry of Agriculture and friends, respectively. This implies that the old habit of getting planting materials from neighbours by cocoa farmers is still in existence and common in the study area. This may perhaps lead to recycling of pests and diseases on the farms.

Moreover, the table revealed that majority of the farmers (75.00%) carried out clearing operation on the farms while planting, weeding and spraying were carried out by 71.67,

percent, 73.33 percent and 78.33 percent, respectively. Similarly, prunning and harvesting were carried out by 66.67 percent of the farmers. The implication of these results is that the farmers are knowledgeable in all these cocoa agronomic practices.

Table 3 below shows distribution according to the marketing channels among the farmers. The result shows that 91.53 percent of the farmers chose local buying agents as channels through which their product gets into the market while about 8.47 percent sell to licensed buying agents. The implication of this is that majority of the farmers are smallholders who see the local buying agents as a faster means of getting cash from the sale of their produce. In addition, it was revealed that about 41.66 percent of the farmers produced between less than 500kg/ha of cocoa from their farms while 28.35 percent produced above 1000kg/ha. This justifies that the farmers farm on small hectarage of land. Furthermore, majority (96.70%) of the farmers in the study area sold their cocoa beans between 500-1000 naira/kg. The implication of this is that all the farmers had information on the prevailing market prices for their produce and may probably sell as the needs for money arose. Moreover, about 75.00 percent of the farmers agreed they pay taxes to the government while 55.00 per cent taxes paid taxes that are above 500 naira per annum. This implies that farmers are conscious of government revenue from taxes.

Table 4 below reveals the distribution of the farmers according to common insect pests and diseases on cocoa farms in the study area. The result shows that termite was seen as most common insect pest by about 76.67 percent of the farmers while about 3.33 percent of the farmers reported black ant common insect pest of cocoa. This implies that the termite infestation of cocoa farms is a serious problems among th farmers in the study area. Similarly, black pod disease and cherelle wilt were seen as the most common diseases by about 70.00 percent and about 28.33 percent of the farmers respectively. This implies that black pod disease still remains a disease of cocoa in the humid region of Nigeria.

Table 5 below shows the distribution of farmers according to constraints and intention to increase cocoa production. It was revealed that about 80.00 percent of the farmers identified non-availability of improved varieties of cocoa as a constraint. Similarly, credit accessibility, high cost of agrochemicals and inadequate marketing channels were seen as constraints to cocoa production by 88.33 percent, 90.00 percent and 88.33 percent, respectively. However, contrary to a priori expectations based on the above results of constraints in cocoa production, majority of the farmers (80.00%) in the study area had intentions to increase their production.

Conclusion and Recommendations

The study was carried out to have a data bank of the operations of cocoa farmers in the study area. The study showed that majority of the farmers still produce on a small scale. Farmers should be encouraged to increase their farm holdings through the provision of enabling policies such as liberalization of cocoa markets, accessibility of improved varieties of cocoa and the removal or mitigation of identified constraints to cocoa production in the study area.

References

Adebile, O. A., Amusan, A. S. 2011. The Non-Oil Sector and the Nigeria Economy. A Case Study of Cocoa Export Since 1960. *International Journal of Asian Social Science. 9(1): 142-151.*

Adebiyi S. and Okunlola J. O. (2013). Factors Affecting Adoption of Cocoa Farm Rehabilitation Techniques in Oyo State of Nigeria. World Journal of Agricultural Sciences. 9(3): 258-265.

Adeogun S. O, Olawoye, J. E. and Akinbile I. A. 2010. Information source to cacao farmers on cacao rehabilitation tecniques (CRTs) in selected States of Nigeria. J. Media and Commun. Stud. 2:009-015.

Girei, A. A., Daura, Y., and Dire, B. (2013). An Economic Analysis of Groundnut (*Arachis hypogeal*) Production in Hong Local Government Area of Adamawa State, Nigeria. *Journal of Agricultural and Crops Research. Vol 1 (6):84-89.*

Nwachukwu, I.N., Ezeh, C.I., and Emerole, C.O. 2012. Effect of Climate Change On Cocoa Productivity In Nigeria. *African Crop Science Journal, Vol. 20, Issue Supplements 2 :487 – 491*

Taiwo, O., Ogunlade, M. O., Ayegboyin, K. O., Famaye, A. O., Adeniyi, D. O., Oyedokun, V. A., Adeosun, S. A. and Adejobi, K. B. 2015. Factors affecting the practice of cocoa rehabilitation techniques in Nigeria: A case of South-west and South-south geo-ecological zone. *International Journal of Advanced Agricultural Research IJAAR 3 (2015) :25-30.*

The Sun Newspaper 2013. Cocoa Contributes $900 million to Nigeria's economy in 2012. www. sunnewsonline.com. Downloaded on 17/11/2013.

World Cocoa Foundation (WCF) 2014. Cocoa Market Update. : 1-11

Table 1: Socio economic characteristics of Cocoa Farmers in Edo State

Variables	Frequency	Percentage (%)	Mean	Std. Deviation
Gender				
Male	52	86.67		
Female	8	13.33		
Age (Years)			**48.6**	**10.6**
21-30	7	11.67		
31-40	5	8.33		
41-50	19	45.00		
Above 50	29	46.68		
Marital Status				
Married	55	91.67		
Single	5	8.33		
Educational Level			**2.13**	**0.89**
No Formal Education	15	25.00		
Primary	27	45.00		
Secondary	13	21.67		
Tertiary	5	8.33		
Membership of Farmers'Group				
Yes	23	38.33		
No	37	61.67		
Household Size			**7.8**	**3.34**

1-5	16	26.67		
6-10	31	51.66		
Above 10	13	21.66		
Farm Size (Hectares)			**2.7**	**1.8**
< 1	2	3.33		
1-5	53	88.35		
6-10	5	8.33		

Source: Field Survey, 2021 Std. Dev: Standard Deviation

Table 2: Cropping Patterns, Varieties of Cocoa Grown and Sources of Planting materials by the Farmers

Variable	Frequency	Percentage
Sole Cocoa		
Yes	55	91.67
No	5	8.33
Cocoa-Arable		
Yes	41	68.33
No	19	31.67
Cocoa/Tree Crops		
Yes	29	48.33
No	31	51.67
Amelonado		
Yes	38	63.33
No	22	36.67
F3 Amazon		
Yes	29	48.33
No	31	51.67
Hybrid (CRIN Varieties)		
Yes	6	10.00
No	54	90.00
Source of Planting Material		
Self/Own Farm	19	31.67
Inherited	18	30.00
Friends	6	11.00
CRIN	0	0.00
Ministry of Agriculture	17	28.00
Clearing		
Yes	45	75.00
No	15	25.00
Planting		
Yes	43	71.67
No	17	28.33
Weeding		
Yes	44	73.33
No	16	26.67
Spraying		
Yes	47	78.33
No	13	21.67

Prunning		
Yes	40	66.67
No	20	33.33
Harvesting		
Yes	40	66.67
No	20	33.33

Source: Field Survey, 2021

Table 3: Distribution according to the Marketing Channels among the farmers

Variable	Frequency	Percentage
Quantity Produced (Kg/ha)		
<500	25	41.66
500-1000	19	31.68
Above1000	16	28.35
Price of Cocoa beans (₦ /Kg)		
500-1000	58	96.70
>1000	2	3.30
Tax/Levy		
Yes	45	75.00
No	15	25.00
Amount of Tax (₦/Yr)		
<500	27	45.00
500 Above	33	55.00

Source: Field Survey, 2021

Table 4: Common insect pests and diseases on cocoa farms

Insects	Frequency	Percentage
Termite	46	76.67
Caterpillar	12	20.00
Black ant	2	3.33
Diseases		
Blackpod Disease	42	70.00
Cherelle Wilt	17	28.33
Green carpet	1	1.67

Source: Field Survey, 2021

Table 5: Distribution according to constraints and intention to increase cocoa production

Variable	Frequency	Percentage
Improved Cocoa Varieties		
Yes	48	80.00
No	12	20.00
Land Availability		
Yes	32	53.33
No	28	46.67
Credit Accessibility		
Yes	53	88.33
No	7	11.67
High Cost of Agrochemicals		
Yes	54	90.00
No	6	10.00
Inadequate Marketing Channels		
Yes	53	88.33
No	7	11.67
Storage Facilities		
Yes	15	25.00
No	45	75.00
Labour Shortage		
Yes	17	28.33
No	43	40.68
Fire Incidents		
Yes	31	51.67
No	29	48.33
Weather Impact		
Yes	51	85.00
No	9	15.00
Intention to increase production		
Yes	48	80.00
No	7	11.67
Indifference	5	8.33

Source: Field Survey, 2021

Year of report: 2021

PROGRAMME: ECONOMICS AND EXTENSION (DATABANK)

TITLE: REPORT OF CASHEW SURVEY DATA BANK IN ABIA STATE

LIST OF INVESTIGATORS: Oduwole, O.O., Lawal, J.O., Obatolu, B.O., Taiwo, O and A.T. Yahaya

Introduction: The dearth of data on Cashew as it relates to production and the farming households has affected planning and policy decisions at different levels. Many quarters have proved that CRIN should be the base for the collection of data on all its mandate crops. Data bank system involves a lot of information collection, generation and modeling to meet the need of various users of information such as farmers, industrialists and other stakeholders. It requires careful data collection and management for the needs of the various users of information.

Justification

There is no existing reliable data platform for CRIN mandate crops and the available ones are not adequate and not reliable and timely, hence, there is a need to complement it to make it more robust. Various agencies and private sectors have different information on cashew and the available ones are limited to just production and price. However, there is need for information on socio-cultural variables, biological variables, soil and spatial information (GIS).

Objectives:

1. Collection and management of baseline information on cashew;
2. To provide the network with other local and international bodies.

Methodology: This will involve desk research, field survey and interactions' with various stakeholders and scientists. Data bank is a continuous and dynamic process involving modeling techniques for the management of information. It involves a lot of rules for the coding system . Personal interviews and the use of questionnaires to collect data and the data set requirement will include the following:

- Socio-economic and physiological data, Weather data, Soil nutrients and water balances,- Phenolic and growth data (variety, acceptability, cultural);- Agronomic data
- Disease and pest data- level of infection and damage;- Pesticides and their products
- Risk or uncertainty data; production, processing and consumption patterns

The cashew data bank survey in Abia State was carried out in three local government area of the state namely: Umumeneochi, Isikuwato and Abia North local government area.

This report is subdivided into the following major heading:

I I. Socio- economic characteristics of the cashew farmers

II II. Planting history of the cashew farmers

III. Cashew agricultural practices and rehabilitation methods

IV. Major constraints faced by farmers

V. Awareness of cashew production factors

VI. Proffered solutions by the farmers

The Socio-Economic Characteristics of Cashew Farmers

The socio-economics of the cashew farmers is an important aspect of the cashew databank as it contributes positively or negatively to the production of the cashew in the study area. Such demographic characteristics like age, gender, educational levels, membership of associations, mode of land acquisition, sizes of farm among others were considered and analyzed.

Results of analysis from the survey carried out shows that most of the farmers are male (68.3%) and are primarily farmers (58.7%) though some are traders (27%) while very few are found to be civil servant. The analysis further shows that majority of the farmers (28.6%) have over twenty years of cashew farming experience, while 7.9% has 40years of experience this shows that the farmers have a good number of years of experience in cashew farming. The analysis further shows that majority (52.4%) have secondary school education while 19% have tertiary education thus indicating that the cashew farmers had good level of education and therefore are capable of adopting good agricultural practices in cashew production.

Further analysis shows that the farmers' average age is 50 years with an average household size of 7-8 members constituting 15.7% of the respondents. Also an average of 5 members of the household assists the farmers in cashew farm work and other operation. This indicates that an average farmer in the area is young and agile to face cashew farm work thereby boosting cashew production more so that there is evidence of fairly large household size and members assistance in farm operation. The analysis also shows that 81% of the farmers belong to one association or the other of which 19% belong to Abia farmers' multipurpose cooperatives. Indicating a good medium for farmers to market their cashew products for better price and get better information on cashew operations.

Twenty percent of the respondents have an average of 2ha of land for their cashew farm of which most of them (75%) were acquired through inheritance. This indicates that most of them operate on small/medium scale of cashew production and the cashew farms are passed from one generation to the other.

PLANTING HISTORY

The survey revealed that majority of the farmers have 200 cashew trees that is below the age of 5 years, about 300 trees between the age of between ages 10-15 years,400 trees planted between the ages 15-20years. And 80 trees between the ages 20 -25 years. The farmers mostly planted small and medium variety of cashew seeds with very little number cultivating jumbo variety. This is so because it is believed that the small and medium cashew varieties produce more seeds which is the commercial product. It was also found that there was over 70% survival rate of the cashew seeds when propagated at stake.

An average of 75 and 58 bags of cashew nuts were produced for the main and light season respectively for the year 2017/ 2018 production year while an average of 84.20 and 78.13 bags were produced during the main and light season of 2019/2020 thus showing that there is progress in production. The survey analysis also revealed that most of the cashew farmers weed their cashew farms once a year and none of them apply fertilizer on their cashew farm nor carried out any soil test before planting. Almost all the farmers indicated that the most important part of the cashew harvested is the seed while the fruits aspect is been neglected to rot away or eaten by people however, only few sell out the fruit part.

Cost of cashew fruits were found to be N322, 475.11, and N628.67 on the average for the year 2018, 2019 and 2020 respectively thus showing a progressive increase in price for those years. The costs of cashew nuts were found to be between 650- 1200 naira per kilogram between the 2018-2020 production years. The price however, is not stable depending on the time of the season and market demand and supply for cashew nuts.

PROJECT RESULTS AND DISCUSSION 2

This research was conducted in Abia State to identify the constraints to cashew production and how important they are, it examines the level of awareness in cashew production providing some important parameters and points out certain suggested solutions for cashew farming to decide how relevant they are to improving its production in the state.

Table 1.0: Constraints to the Production and Marketing of Cashew

Perceived Constraints	Highly important (%)	Less important (%)
Inadequate information on cashew production	22%	27%
High taxes and unfavourable government policy toward cashew	27%	18%
Climate change affects cashew Production	24%	21%
Inability to access government assistance on production	22%	40%
Inability to access government assistance in marketing	46%	13%
High risks and uncertainty in Agric	46%	11%
Poor access to inputs and chemicals	25%	16%
No access to improved planting materials	33%	19%

Need of training on post-harvest handling	40%	8%
Incidence of pest and diseases	48%	10%
Poor access roads to cashew plots	19%	30%
Poor access to credit facility	44%	18%

Source: Field Survey, 2021

The result in table 1.0 shows that incidence of pest and diseases, high risk and uncertainty in Agriculture, inability to access government assistance in marketing, poor access to credit facility and need of training on post-harvest handling are the most important constraints to the production and marketing of cashew in Abia state. It also shows that inadequate information on cashew production, inability to access government assistance on production and poor access to roads leading to cashew plots are of least importance and therefore have a very low impact on the production and marketing of cashew in the research area.

Table 2.0 Level of Awareness in Cashew production

Variables	**Very much aware (%)**	**Not aware(%)**
Use of agrochemicals	25%	13%
Cashew farm sanitation practice	16%	11%
Varieties of Cashew	14%	13%
Planting population	10%	21%
Research advances in cashew production	11%	24%
Marketing channels	8%	16%
Processing problem	11%	11%
Stakeholders in the value chain	16%	8%
Good agricultural practices	18%	6%
Mitigation/adaption to climate change	13%	18%

Source: Field Survey, 2021

Table 2.0 shows the level of awareness of the respondents in cashew production concluding that they were very much aware of the use of agrochemicals, cashew farm sanitation, varieties of cashew, stakeholders in the value chain, and good agricultural practices but were not aware of practices like; planting population, research advances in cashew production, marketing channels, and mitigation/adaption to climate change.

Table 3.0 Suggested solutions for cashew farming and their relevance

Variables	**YES (%)**	**NO (%)**
Information on improved cashew production technology	71%	27%
Better government policy towards farm practices	67%	32%
Information on mitigating climate change to farmers	54%	44%
Training on how to access government	71%	27%

assistance in marketing especially taxes and tariffs		
Improved government assistance in marketing especially taxes and tariffs	51%	48%
Set up marketing boards to control prices and trade	68%	30%
Provision of good infrastructure like roads to farmers plot	64%	35%
Assistance on accessing credit facility from banks at low interest	67%	32%

Source: Field Survey, 2021

The cashew farmers were asked to identify how relevant some of the suggested solutions are to cashew farming and the result of the analysis shows that all of the implied solutions are relevant to the marketing and production of cashew. Some of them are; information on improved cashew production technology, Better government policy towards farm practices, Information on mitigating climate change to farmers, Training on how to access government assistance on production, Improved government assistance in marketing especially taxes and tariffs, Set up a board to control prices and marketing of cashew nuts.

Conclusion /Recommendations

The survey carried out shows that the majority of the farmers are male farmers, educated but are not familiar with good agricultural practices for cashew production. They operate on small-medium scale cashew production. It was also observed that there are no organized market(s) for cashew in Abia state as farmers are at the mercy of the buying agents. Most of them do not adhere to good agricultural practices of cashew production.
This study hereby recommends that cashew farmers in the state be assisted and trained on the reduction of the incidences of pests and diseases, adaptation and mitigation of climate change effects on cashew to help reduce the risks and uncertainties in production and linking them to markets.

In the same vein, there is the need for these farmers to be formed into viable groups through which they can benefit on credit access, marketing and post-harvest management trainings. Also, there is the need for the farmers in Abia state to be trained on the basics of cashew plant population and the need for the recent advances in cashew research and viable marketing channels for their products disseminated to them.

Dissemination of CRIN Developed Technologies among end-users in Ondo

A. E. Agbongiarhuoyi., Orimogunje, O.A., Adebiyi, S., Abdulkarim, I. F, Williams, O. A., Oduwole, O.O. and Igbinadolor, R.O.

Introduction

One of the major objectives of Cocoa Research Institute of Nigeria (CRIN) is to investigate the effective utilization of the crops, by-products and the feasibility of small- scale production of such end-use product. Based on this objective, agricultural development in the country depends on the successfuldissemination and implementation of agricultural research information to farmers, processors, marketers, consumers and other stakeholders by qualified extension experts. The Cocoa Research Institute of Nigeria (CRIN), over the years developed a lot of technologies and some were extended to end-users in the southwest and other parts of Nigeria throughFarmers' field day, exhibition, training, demonstration, radio and excursion visits to CRIN and to farmers' farms. Examples of some of these technologies include cocoa bread, cocoa powder, liquid soap, cashew kernel, kola wine, coffee wine and green tea. A critical assessment of the extent of utilization these technologies will help ensure improvements where necessary, income generation, job creation, food and nutrition security of the country and bring feedback from end-users to researchers.

Objective of the study

The general objective of this study was to assess the utilization of selected CRIN developed technologies in Ondo State.

The specific objectives were to:

- describe end-users' socioeconomic characteristics in the study area;
- create awareness of selected CRIN developed technologies and examine its utilization;
- ascertain the availability and utilization of selected CRIN developed technologies;
- identify the sources of information on utilization of CRIN developed technologies and
- examine the constraints encountered by end-users in utilization of CRIN developed technologies.

Methodology

The study was carried out in Ondo State of Nigeria. A multistage sampling procedure was used for the study. Firstly, Ondo state was purposively selected because CRIN technologies had earlier been introduced to the farmers, consumers and Extension agents and also due to

the fact that Ondo is the highest producer of cocoa in Nigeria. Secondly, two Local Government Areas (LGAs) markets were purposively selected due to the nearness of CRIN substation and thecommercial nature of the locations Akure South (Isikan market) and Idanre (Owena market).100 persons (buyers and sellers) were selected using simple random sampling in Isikan market because it is a big marketwhich holds on a daily basis while 50 respondents were also selected using simple random sampling in Owena market which is a peri-urban market and marketing activity is once in every five days.Participants were selected among the registered traders in Isikan and Owena markets through the *Iyaloja* and *Babaloja.* Buyers were also asked to join the event by the leaders of the market chosen. Representative of ADP Extension agents were also involved in order to further disseminate the information to farmers. The total sample size was 80 respondents. The selected CRIN developed technologies that was exhibited during study were Cocoa bread, Cocoa powder, Cocoa wine, Liquid soap, edible cashew nuts, kola wine, coffee wine and green tea. At the end of the programme, 130 Questionnaire were administered to participants in order to get their feedback on disseminated products.

Pictures speaks

Plate 1: Director E&E and other researchers at Isinkan market

Plate 2: Director E&E introducing CRIN products to consumers at Isinkan market

Plate 3: Display of CRIN products by researchers at Isinkan market

Plate 4: Display of CRIN developed products by researchers at Owena market

Results and Discussion

1. **Brief opening ceremony and introduction of CRIN Developed Technologies to the public**

The CRIN dissemination event was held on the 16th of December, 2021 at Isinkan and Owena markets in Ondo State. There was a brief opening ceremony coordinated by the Director, Economics and Extension CRIN, Dr Oduwole, O.O. He welcomed all participants to the event on behalf of the Executive Director Dr Patrick Adebola. Dr Oduwole introduced the CRIN products to everyone and urged them to use the products to create job opportunities, provide income, improve their health and food security. The head of Extension Mr. Agbongiarhuoyi E. Anthony told all interested and willing business men and women that the uptake process in any of the technologies is simple. They were encouraged to visit CRIN and they will be well attended to. The *Iyaoloja* of *Isinkan* market appreciated CRIN for exposing the products to them at their market. She said the products were nice and CRIN should make it available and affordable for their traders.

The developed products brought by CRIN were introduce to the participants by Dr Adebiyi, S. and Abdul-karim, I.F. in order to create much awareness and encourage uptake by interested up-takers. The products include were Cocoa bread, Cocoa powder, Chocolate, Cocoa wine, Liquid soap, cashew kernel, kola wine, coffee wine and green tea.

2. **Testing of CRIN Products**

cocoa bread was cut into smaller sizes and distributed to all the participants, wines from all our mandate crops was served as well. Pure cocoa powdered beverage without milk and sugar was served. Also, cocoa powdered beverage with sugar was prepared. The participants tested all our products. They told us what they observed:

Immediate feedback:

Most of the respondents commended CRIN for the awareness created on the developed products.The following feedback how the products can be improved are stated as follows:

- **Availability of the product**: Most respondents pleaded with CRIN to make products more available most especially Cocoa powder because of its health benefits. Also, Cocoa bread, cashew kernel, cocoa butter cream and all the wines should be made available to the public.
- **Price**: The price of the products should be reviewed downward, so that more consumers can afford it.

- **Packaging**: It suggested that CRIN should improve on packaging of the developed products in order to be more attractive.
- **The youths** in Owena community who visited the exhibition stand of CRIN in the market liked the products and wants CRIN to trained them on soap and bread making in order to empower them.

Media coverage: The dissemination event was covered by an online New Telegraph Newspaper. The link is enclosed for your perusal.

https://www.newtelegraphng.com/cocoa-institute-creates-technologies-combat-unemployment/

It was also reported in Ondo State Broadcasting (OSBC) news both Radio and Television.

Data Analysis of feedback from interview schedule administered is on-going.

Conclusion and Recommendation

CRIN developed technologies were successfully disseminated at both *Isinkan* and *Owena* markets. Consumers, business men and women welcomed the idea of bringing the products to their locations. They expressed willingness to use the products especially cocoa powder, cocoa bread, cocoa butter cream, chocolate, cocoa wine and kola wine. They advised CRIN to make the products available and accessible to the general public for optimum utilization.

2021 Extension Activities Report

Dissemination of CRIN Developed Technologies among end-users in Lagos State

A. E. Agbongiarhuoyi., S. Awodumila, D.J. Mokwuye, F.C., Agbebaku. E. E. O.,Oha, K.F., Rahman., S., Dinne, C.E., F.B. and Mustopha, F.B.

Introduction

The Cocoa Research Institute of Nigeria (CRIN), over the years developed a lot of technologies from her mandate crops. Some of these technologies are on shelf and needs to be extended to end-users in Nigeria through exhibition, training, demonstration, radio, television and workshop. Agricultural research technologies are essential inputs in agricultural education, research, development and extension services. To a great extent, agricultural development depends on the successful implementation of disseminated agricultural research information to farmers, processors, marketers, consumers and the general public Mubofu (2017). A critical assessment of the extent of utilization of these technologies will help ensure improvements where necessary. CRIN technologies help to provide income, job creation, food and nutrition security of the country. This is very much in line with the diversification agenda of the Federal Government from the oil to non-oil sector in Nigeria. It was a one-day event which was held on 23 March, 2022 at Jara Mall Ikeja, Lagos.

Objective
The major objective was to extend some CRIN developed technologies to end users in Lagos State. The specific objectives were to exhibit and promote CRIN developed technologies to end-users.

Methodology
The project was carried out in Jara Mall Ikeja, Lagos State of Nigeria. Lagos State was purposively selected because of its commercial nature and CRIN technologies had earlier been introduced tosome traders and Extension agents. Participants were selected from traders within and outside Jara Mall premises with the help of the manager of the organization. Representative of ADP Extension agents were also involved in order to further disseminate the information to farmers. Also, Lagos Agricultural Development Authority (ADA), Agribusiness, business men and women and the commissioner for Agriculture who was ably represented by the Director of Agribusiness were invited to be part of the event.
The CRIN developed technologies that were exhibited during the programme were Cocoa bread, Cocoa powder, Liquid soap, cashew kernel, Chocolate, Cocoa wine, Kola wine, Coffee wine, Cashew wine and Tea wine.

Results and Discussion
Activities of the programme

1. **Introduction of guests and media practitioners**

The programme was attended by many dignitaries including commissioner for agriculture, Lagos State who was represented by the State Director of Agric business, Mrs Aramide Dansalu, an Extensionist from Nigeria Institute of Oceanography and Marine Research(NIOMR), Dr Gloria Ikeyoweto Omogho, Acting Director of extension service, Lagos State Ministry of Agriculture and Rural Development, Mrs Ebota Olusola official of radio Nigeria Lagos branch, News agency of Nigeria among others.

2. **Opening remarks by CRIN**

The Executive Director, CRIN, Dr. Patrick Adebola in a remark stressed on the importance of the products, saying their health benefits ranged from reducing hypertension, curing diabetes as well as serving as antidote to malaria symptoms and boosting the brain function. ED charged investors to take up the responsibility of mass production to further increase the volume of the nation's agro products for export and for local consumption thereby enhancing the economy. He said "The Cocoa Research Institute of Nigeria (CRIN) was established in 1964 to carry out research and development on five major crops which are cocoa, kola, coffee, cashew and Tea. He emphasized the reasons for displaying products from CRIN mandate crops. The intention is to disseminate this to the community and to Nigerians in general to see if there are investors that will be interested in coming to take up these technologies that have been in our shelves

3. **Brief speech from the Hon. Commissioner for Agriculture, Lagos State**

The Lagos state Hon. Commissioner for Agriculture, MrsAbisolaOlusanya who was represented by Director of Agric Business, MrsAramideDansalu explained that the value addition on the affected crops would bring about increased job and wealth creation for Nigerians, in addition to addressing nutritional deficiencies among both children and adult citizens .She added that, "the expansion of the value chain is good as it will bring about value addition to what we produce and that the research products , particularly those from CRIN would go a long way in bringing the commodity to consumers while promising that she will

visit CRIN and make sure they take these products to farmers . She appreciated CRIN for bringing such programme to Lagos and that Lagos State is ready to partner with CRIN.

4. **Introduction of CRIN Developed Technologies/ Products to the public.**

The Head of Extension Section CRIN, Mr Anthony Agbongiarhuoyi stated the institute was given five mandate crops by the Federal Government these crops are Cocoa, Kola, Coffee, Cashew, and Tea. He stressedthe products from the mandate crops which are Cocoa bread, Cocoa wine, Coffee wine, Tea wine, Cashew wine, Cocoa powdered, Liquid soap, milk chocolate among others. He called on the Lagos State government to adopt some of the products for its school feeding programme, explaining that a particular product from cocoa contains the needed nutrients that boost brain power and that if used in feeding school children could enhance their ability to learn.

5. **Testing of CRIN Products**

Cocoa bread was cut into smaller sizes and distributed to all the participants, wines from all our mandate crops was served as well. Cocoa powdered beverages with milk and sugar was served. Also, raw cocoa powdered beverage was prepared. The participants tested all our products. They later told us about what they observed.

6. **Feedback from the participants**

The participants commented that the wax in the body cream and balm must be increased to prevent it from being melting easily.
They said the level of alcohol in tea wine was too high.
They cocoa powered beverage was too bitter
CRIN should improve on the packaging of our products.

Media coverage: The event was adequately covered by Federal Radio Corporation of Nigeria (FRCN) Lagos, Punch Newspaper, KAFTAN online Television and Lagos City News. The links are enclosed for your listening and viewing.

1. https://www.buzzministry.com/2022/03/24/crin-sensitises-lagos-public-on-20-research-products-from-cocoa-others/

2. https://punchng.com/nigeria-should-not-rely-on-exporting-cocoa-alone-says-crin-ed/

3. www.kaftan.tvhttps://youtu.be/C-JwwLVrs_Y

Photo speaks

Products' Banner

Representative of the Hon Commissioner, Lagos State

CRIN products displayed

Cross section of Participants and invited guests at the event

Closing Remarks: The head of Extension appreciated the participants and invited guests for honoring the invitation to attend the programme. The event came to an end around 4:30 pm.

Conclusion and Recommendation

The event was successful and created lagosians the opportunity to be aware and use CRIN developed products. This was the first of its kind in Lagos State. Participants expressed willingness and interest in up taking some of the products. The Lagos State Government was particularly interested in taking the cocoa powder consumption for school feeding programme due to its health benefits. The representative of the honorable commissioner for agriculture told reporters that Lagos State government was ready to partner with CRIN in utilizing CRIN products which could enhance local processing, create job opportunities, provide income and improve food and nutrition security. The participants appealed to CRIN to make the products available in the market so that people can have access to them.

Reference

Mubofu, C. (2017). Disseminating Agricultural Research Information: A case study of farmers in Mlolo, Lupalama and Wenda villages in Iringa district, Tanzania. University of Dar es Salaam Library Journal, Vol 12, No 2 (2017), pp-80-97.

Structure and Use Pattern of Labour Among Cocoa farmers in Nigeria

Oluyole, K.A., Akinpelu, A.O. and Yahaya, A.T.

Introduction

Nigerian agricultural sector is dominated by small-scale farmers whose farms vary between 0.10 and 5.99 hectares in size and constitute about 80.35% of all the 29,800 million farm holdings in Nigeria (Ayanwale, 2002). Their farmers used traditional technologies called hoe-cutlass culture and their capital structure is in form of small tools and predominant usage of family labour (Oluyole et al, 2009). Human labour is about the only main source of labour available to smallholder farmers in Nigeria. Smallholder farmers contribute over 85% of domestic agricultural output in Nigeria, hence, human labour accounts for domestic food supply in Nigeria. Therefore, the needs to continue supplying food the ever-growing Nigerian population anchors on human labour productivity. In Nigerian agriculture, hired labour is predominantly used. In fact, it carries 88% of the total labour used on farms (Okuneye, 2000). Apart from hired labour, the other types of labour that could be employed are family labour and cooperative labour. The availability of labour has been found to have impact on planting precision, better weed control, timely harvesting and crop processing (Oluyole, et al, 2007). Therefore, labour is a major constraint in peasant production especially during planting, weeding and harvesting (Gocowski and Oduwole, 2003). According to Lele and Stone (1989), rapid growth in population which increases farm labour supply exerts so much pressure on land and reduces farm size per hectare. Empirical evidence has shown that available labour force comprised mostly of old people to the exclusion of young men and women within the active working age thus having a negative impact on agricultural productivity. This is because the role of youths in agricultural production cannot be over-emphasized.

With the foregoing, it could be observed that human labour plays a very significant role in agricultural development especially in the developing countries in which the level of technological development is still very low. In view of the importance of labour in agricultural production, this study was designed to investigate the structure and use pattern of farm labour in the study area.

Methodology

The project was carried out among cocoa farmers in Ondo State. Ondo East Local Government Area (LGA) was purposively selected from the State and from the LGA, Laagba community was also purposively selected because cocoa farmers are mostly concentrated in the community. Simple random sampling technique was used to collect data from a total of 144 farmers randomly selected from the community. Data were collected from the respondents with the aid of structured questionnaire and the data obtained from the questionnaire were analysed using Descriptive analysis. Descriptive Statistics was used to describe the socio-economic characteristics of the farmers as well as the structure and use of labour pattern in the study area.

Results and Discussion

The result of the socio-economic characteristics of the farmers is shown in Table 1. The table shows that 74.99% of the total respondents are above 50 years of age indicating that the proportion of old people among the respondents is very high. Meanwhile, only 25.01% of the total respondents were 50 years and below. The lowness in the proportion of the youths is a bad pointer to cocoa production efficiency as younger farmers are more active on farm work than the aged ones. Table 1 also shows that 79.17% of the respondents were males. This is quite obvious in that farm work is a tedious work and is only men that could cope effectively with it. Apart from this, most of the farms were inherited and some traditional cultures permit only the male children to inherit farms. As regards the educational level of the respondents, the result of the analysis shows that 75.07% of the respondents were having formal education. This would improve the efficiency of the farmers in as much that literate farmers would find it easier to adopt new technologies on cocoa than the illiterate ones. The analysis on farm size shows that 66.67% of the respondents had farm size of 5 hectares andbelow which shows that most of the farmers are small scale farmers. Table 1 also shows that 50.0% of the farmers had the age of their farms greater than 30 years showing that most of the farms are old and hence the farm's productivity would reduce, therefore such farms needs to be rehabilitated. This is a good pointer to an increased productivity. Table 1 also revealed that majority (75.00%) of the farmers had purchased farms while just 12.5% inherited their farms.

Table 1: Socioeconomic Characteristics of Farmers

Variables	Frequency	Percentage
Age of farmers (years)		
≤ 30	6	4.17
31-40	6	4.17
41-50	24	16.67
51-60	48	33.33
>60	60	41.66
Total	144	100.00

Sex of farmers		
Male	114	79.17
Female	30	20.83
Total	144	100.00
Educational Status		
No formal education	36	25.00
Primary education	36	25.00
Secondary education	54	37.50
Tertiary education	18	12.50
Total	144	100.00
Marital Status		
Single	0	0.00
Married	126	87.50
Widow/widower	12	8.33
Divorced	6	4.17
Total	144	100.00
Farm size (Ha)		
≤ 5	96	66.67
6-10	30	20.83
11-15	18	12.50
Total	144	100.00
Age of farm (years)		
≤ 10	6	4.17
11-20	24	16.66
21-30	42	29.17
31-40	36	25.00

41-50	18	12.50
>50	18	12.50
Total	144	100.00
Nature of ownership		
Inherited	18	12.50
Purchased	108	75.00
Rented	12	8.33
Sharecropping	6	4.17
Total	144	100.00

Source: Field survey, 2021

Table 2 shows the structure of labour according to the different types of labour used for different activities in cocoa farming. The table shows that contract type of labour is majorly used for most activities in cocoa farming. However, cooperative labour was seldom used for any activity showing that cooperative labour is no more utilized in cocoa farming in the study area. Family labour is also utilized for all activities but at different magnitude. Activities such as land clearing, planting, weeding, application of chemicals, removal of mistotoes, harvesting of cocoa pods, conveyance of cocoa pods to the pod breaking point, breaking of cocoa pods and conveyance of cocoa beans to the point of fermentation were majorly carried out by contract labour. This is because 75.0%, 83.32%, 95.83%, 91.67%, 87.50%, 87.50%, 95.83%, 100.0% and 88.33% of the farmers respectively indicated that they utilized contract labour for such activities. However, activities such as drying of cocoa beans, parking of dried cocoa beans and preservation of cocoa beans were majorly carried out with family labour

Table 2: Distribution of labour by types of labour used for different activities in cocoa farming

Activities	**Types of Labour**					
	Family		**Contract**		**Cooperative**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
Land clearing	36	25.00	108	75.00	0	0.00
Planting	18	12.5	120	83.33	0	0.00
Weeding	6	4.17	138	95.83	0	0.00
Application of chemicals	24	16.67	132	91.67	0	0.00
Application of fertilizer	12	8.33	108	75.00	0	0.00

Removal of mistotoes	6	4.17	126	87.50	0	0.00
Harvesting of cocoa pods	30	20.83	126	87.50	0	0.00
Conveyance of cocoa pods to the point of pod breaking	24	16.67	138	95.83	0	0.00
Breaking of cocoa pods	42	29.17	144	100.00	0	0.00
Conveyance of cocoa beans to fermentation spot	42	29.17	120	88.33	0	0.00
Fermentation of cocoa beans	42	29.17	96	66.67	0	0.00
Conveyance of cocoa beans from the fermentation spot to the drying spot	38	25.00	108	75.00	0	0.00
Drying of cocoa beans	144	100.00	12	8.30	0	0.00
Parking of dried cocoa beans	144	100.00	6	4.17	0	0.00
Preservation of cocoa beans	144	100.00	0	0.00	0	0.00

Source: Field survey, 2021.

Table 3 shows the distribution of the labour used for cocoa farm activities based on the gender of the labour. The table shows that male labours were mostly utilized for all the activities as indicated by most respondents. On the otherhand, female labour were sparingly utilized for some activities such as land clearing, planting, application of chemicals (spraying of chemicals), removal of mistotoes and harvesting of cocoa pods as only 8.33%, 0%, 8.33%, 4.17%, 0% and 12.5% of the farmers respectively indicated that they use female labour for the respective farm activities. However, female labour were mostly used for conveyance of cocoa pods to the point of pod breaking, breaking of cocoa pods, conveyance of cocoa beans to the spot for fermentation and drying of cocoa beans.

Table 3: Distribution of labour by the gender of labour used for different activities in cocoa farming

Activities	**Gender of labour**			
	Male		**Female**	
	Freq	**%**	**Freq**	**%**
Land clearing	144	100.00	12	8.33
Planting	144	100.00	0	0.00
Weeding	126	87.50	12	8.33
Application of chemicals	126	87.50	6	4.17

Application of fertilizer	114	79.17	24	16.67
Removal of mistotoes	126	87.50	0	0.00
Harvesting of cocoa pods	114	79.17	18	12.50
Conveyance of cocoa pods to the point of pod breaking	120	83.33	126	87.50
Breaking of cocoa pods	126	87.50	132	91.67
Conveyance of cocoa beans to fermentation spot	144	100.00	138	95.83
Fermentation of cocoa beans	120	83.33	12	8.30
Conveyance of cocoa beans from the fermentation spot to the drying spot	120	83.33	132	91.67
Drying of cocoa beans	138	95.83	120	83.3
Parking of dried cocoa beans	126	87.50	30	20.83
Preservation of cocoa beans	132	91.67	24	16.67

Source: Field survey, 2021.

Conclusion

The study was carried out on the structure and use pattern of labour among cocoa farmers. The study found out that labour could be structured according to the types of labour (family labour, contract/hired labour and cooperative labour) and according to the gender of the labour. The study further revealed that contract labour is mostly used for activities such as land clearing, planting, weeding, application of chemicals, removal of mistotoes, harvesting of cocoa pods, conveyance of cocoa pods to the pod breaking point, breaking of cocoa pods and conveyance of cocoa beans to the point of fermentation while family labour is mostly used for drying of cocoa beans, parking of dried cocoa beans and preservation of cocoa beans. However, cooperative labour is no more used as a form of labour in the study area. It was found out from the study that

References

Ayanwale, B. A. (2002). Family investment in the Education of Children and Adolescents in Rural Osun State, Nigeria. In: Issues in African Rural Development Monograph Series. No. 21 Winrock International. pp. 9.

Gocowski, J. and Oduwole, S. (2003). Labour Practices in the Cocoa Sector of Southwest Nigeria with a special focus on the role of children. STCP/IITA monograph IITA, Ibadan, Nigeria.

Lele, U.R. and Stone, S. W. (1989). Population, Resource, the Environment and Agricultural Intensification: Variations on the Boserup Hypothesis. MADIA Discussion Paper No. 4, Washington D.C: The World Bank.

Oluyole, K. A., Oni, O. A., Omonona, B. T. and Adenegan, K. O. (2009). Food Security Among Cocoa Farming Households of Ondo State, Nigeria. Journal of Agricultural and Biological Science. 4 (5): 713.

Okuneye, P. A. (2000). “Employment Generating Potentials of Agricultural Processing and Storage Technology: Additional Gain in Increased Food Availability Pursuit” Paper presented at the workshop for local government officials in Lagos state.
Oluyole, K. A., Adebiyi, S. and Adejumo, M. O. (2007). An Assessment of the Adoption of Cocoa Rehabilitation Techniques Among Cocoa Farmers in Ijebu East Local Government Area of Ogun state. Journal of Agricultural Research and Policies. 2 (1): 56-60.

2021 Research Report
Cocoa Research Programme
Cocoa Pests Index Mapping: Case Study of Ondo and Osun States, South Western Nigeria

Dongo, L.N., Adeniyi, D.O., Asogwa, E.U., Orisajo, S.B., and Adeji, A.O.

Introduction:
Cocoa production is common to smallholder farmers in the regions of high biodiversity, which is also characterized with varieties and pests’ complexes. Several factors have contributed todecline and dwindling production of cocoa in which black pod disease iskey in Nigeria and Africa among many other pests. Cocoa unfortunately is threatened by many biotic and abiotic constraints resulting in significant yield losses. Among biotic constraints, diseases and insect pests are the most damaging which compromise the yield in terms of quality and quantity.
Research reports have indicated associations of many pests (virus, fungi, nematode, weed etc) with cocoa and economic implication of these pests on cocoa yield and quality varied among growing communities in Nigeria. *Phytophthora* probably causes more production losses globally than any other disease of cocoa, pathogen has several hundred recorded hosts and is of universal importance in cocoa, causing global yield losses up to 20 to 30% and tree deaths of up to 10% annually, although individual farms in wetter cocoa-growing areas may suffer total loss. However, variations and genus diversity have been recorded in many growing communities especially with the most virulent *P. megakarya* common to West Africa.
In lieu of this, the experiences with pests in other producing countries demonstrate that an early action is of the utmost importance in management and limiting production losses. Unfortunately, despite the socio-economic and environmental importance of cocoa in Nigeria, data on pest index mapping are scarce to obtain. However, such country-specific data especially on cocoa will serve as pre-requisite for development of efficient management strategy and a guide for investor in cocoa production in Nigeria.
The study aim of this study is to fill this gap by compiling an inventory of pests (insects, fungi, nematodes, viruses, weeds, parasites etc) associated with cocoa production across varied ecologies.

The objective is to develop a compendium and banks of pests of concern in cocoa production in growing ecologies of Nigeria.

Materials and Methods

The survey/inventory (distribution and damage characteristics) of pests were carried out in selected cocoa farms in Ondo and Osun states (South West), Nigeria. The pests sampling was carried out between September and October 2021 in three (3) farms each in three (3) different Local Government Areas of the States.The farms were sampled by systematically traversing the plots at both diagonals and longitudinal ends. Cocoa trees were closely observed for insect species, diseases symptoms and weed association on the trees and farms. Farm data was taken which comprised of location, farm name/owner, LGA, crop, date, and plant part collected.

The intercepted insects were identified and characterized.Infected pods, leaves were collected after observation and labelled in sterile Ziploc bags and transported to laboratoryfor further studies. Samples of soils were randomly collected across the farm sites in sterile sample bags and assayed for nematode population.All the farms' sites were geo-referenced and the GPS coordinate recorded.

Cocoa samples and fungi isolates were subjected morphological (identification, photomicrographs) and molecular (DNA extraction, Electrophoresis, PCR, Sequencing) characterization at the molecular facility of UPENDO BIOINFORMATICS SERVICES, Ibadan, Nigeria.The percentages of insect pest infestation of the farms were assessed and the pest mapping of the areas were carried out using four (4) points scale as follows: 10-25% farm infested (low pest incidence), 30-50% farm infested (average spread), 55-75% farm infested (moderately spread),), 76-100% farm infested (widely spread). The nematode assay was conducted by staging the randomly collected soil samples in a sieve underlined with sterile tissue paper layered in doubles. The staging was carried out for five to seven days and nematode population collected in Eppendorf bottles were quantified using stereo microscope.

Result and Discussion

Symptoms Description of intercepted disease: The Black pod developed by an initial symptom with a small translucent spot-on cocoa pod, around 2-3 days after infection, then turns brown, eventually darkens and the spot cover the entire pod between 7 – 14 days under humid conditions. Whitish spores may be produced three to five days after the appearance of the first symptom depending on species. Black pod disease symptoms due to *P. megakarya* are however, characterized by multiple lesions which spread fast and coalesce showing abundant bloom of white zoosporangia on the lesion except for about a centimeter from the advancing margin of the lesions and varied stages of pod development may be infected (Adeniyi, 2019).

Morphological characterization of the intercepted pathogen: White, cotton-like appearance, with dense cottony mycelium. Mycelia are white and fluffy; hyphae are hyaline but multinucleate (coenocytic). Globose oogonia are spherical, with diameter of 25–33 µm). Possess sympodial sporangiophores and spherical amphigynous antheridia. Oospores are globose and aplerotic. Another isolate showed the mycelia as white and fluffy; hyphae are fairly uniform and hyaline. Globose oogonia are pyriform, 22–30 µm in diameter. Oogonium is tapered at the base to a funnel shape. Possess sympodial sporangiophores and elongated

amphigynous antheridia. Oospores are globose and plerotic (fills the oogonium). Yet another isolate showed whitish grey mycelial with dense, fluffy culture. The colony was uniform, cottony to greyish brown, became dark olivaecious with dense aerial mycelium. Mature conidia were septate, colored, and oval-shaped with irregular longitudinal striations.

Microscopic characterization of the intercepted pathogen and sequencing: These activities are on-going and at advance stage of completion.

The nematode assayed showed presence of species of *Melionigyne*and *Parelentycus*in large numbers and many other unidentified species at juvenile stages of growth in all the soil samples.

Developmental stage of black pod disease dependent on susceptibility of cocoa pod (Ndoumbe-Nkeng 2002), there was a link between the fruit developmental stages and pod rot incidence and immature fruits were more susceptible (Deberdt et al. 2007). However, under field conditions, fruit susceptibility to black pod disease depend on the genetic composition of the pathogen population (Ducamp et al. 2004), the climatic conditions (Ndoumbe-Nkeng et al. 2009), and on infectious potential of the pathogen. Susceptibility of a fruit to a disease is a factor of infection efficiency; ratio of lesion density to inoculum density (Xu and Robinson 2010).

The susceptibility of cocoa fruits depended on the developmental stage but not on the position of the fruit on the tree (Takam Soh, 2013), however, Martijn ten Hoopen et al. (2012) stated that susceptibility of cocoa fruit depended on the position of the fruit on the tree, this contradiction was cleared by by the age of the trees in the study farms where increasing amounts of inoculum are deposited on the tree trunk. Susceptibility estimates showed that cherelles were more susceptible to pod rot than young and adult pods and no significant difference in susceptibility between the young pods and adult pods. *Phytophthora megakarya* is the most aggressive fungal pathogen on *Theobroma cacao* L. and poses a major threat to cocoa production in West and Central Africa. It was originally identified in Nigeria in 1979 (Brasier et al., 1981), currently *P. megakarya* is the predominant species responsible for black pod disease of cocoa in the sub region (Opoku et al., 1997, 2000). Every stage of pod development is susceptible to infection, but immature pods are the most susceptible. The first symptom observed on cocoa pods infected by *P. megakarya* is the appearance of a small translucent spot about 2 to 3 days after infection. Under humid conditions, the spot turns brown and then darkens and spreads rapidly to cover the entire pod within 7 to 14 days. Three to five days after the appearance of the first symptom, whitish spores are produced. Pod rot symptoms due to *P. megakarya* however, are characterized by multiple lesions which spread fast and coalesce with an abundant bloom of white zoosporangia on the lesion except for about a centimetre from the advancing margin. *Phytophthora megakarya* has become the main yield-limiting factor for cocoa production in affected areas (Opoku et al., 2000), the documented host range of *P. megakarya* is limited.

3. Ondo State Pests mapping

A: Survey of Bolorunduro LGA, Ondo

Farm 1

Village : Fagbo village

Latitude: 7’6’’13^{o}N
Longitude: 4’58’’19^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* speices
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)
Nematode population: 75

Farm 2
Village: Arugbo village
Latitude: 7’4’’34^{o}N
Longitude: 4’58’27^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species, *Phytophthora* species
Insects intercepted: Insects intercepted: Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*
Nematode population: 3

Farm 3
Village: FagboOja
Latitude: 7’5’’45^{o}N
Longitude: 4’58’’3^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted: Termites, Pod husk borer & Grasshopper
Weeds intercepted: *Dryopteris*
Nematode population: 108

<u>B: Survey of Idanre LGA, Ondo</u>
Farm 1
Village: Aponmuoke-maye village
Latitude: 7’10’’32^{o}N
Longitude: 5’2’’22^{o}E
Diseases intercepted: Black pod, Cherelle wilt, Yellow okra
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted:Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*), Mistletoes
Nematode population: 34

Farm 2
Village: Owena village
Latitude: 7’11’’59^{o}N
Longitude: 5’1’’28^{o}E

Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species, *Lasiodiplodia*species
Insects intercepted: Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Nematode population: 163

C:Survey of Akure South LGA, Ondo
Farm 1
Village: AponmuOlokuta
Latitude: 7’13’’55^{o}N
Longitude: 5’5’’0^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Nematode population: 152

Farm 2
Village: Aponmu
Latitude: 7’13’’53^{o}N
Longitude: 5’5’’0^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*
Nematode population: 289

Farm 3
Village: Aponmu Loba-Loba
Latitude: 7’4’’’41^{o}N
Longitude: 5’3’’19^{o}E
Diseases intercepted: Black pod,Cherelle wilt
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer & Grasshopper
Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)

Table 1: Summary index of major cocoa pests in Ondo State farms

Intercepted pest	Percentage (%) pest Incidence in all farm									Average
	Ondo East LGA			Idanre LGA			Akure South LGA			
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
Diseases										
Black pod disease	20	54	18	22	45	20	10	22	15	25.1%

(*Phytophthora megakarya*)										
Cherelle wilt		12		45						6.3%
Yellow okra				35						
Cocoa Swollen Shoot Viru Disease (CSSVD)		+			+			+		100%
Insect pests										
Cocoa mirids (*Sahlbergellasingularis*)	3	0	0	5	0	0	7	6	5	2.9%
Cocoa stem borer (*Eulophonotusmyrmeleon*)	0	0	0	0	0	0	2	0	1	0.3%
Termites *(Macrotermesbellicosus*)	7	5	9	6	4	0	5	10	8	6%
Shield bug (Bathycoeliathalassina)	0	0	0	0	0	0	4	2	1	0.8%
Pod husk borer *(Characomastictigrapta)*	3	5	7	2	4	0	6	3	3	3.7%
Psyllid *(Mesohomotomatessamanni*	0	3	0	0	4	0	2	0	1	1.1%
Grasshopper (*Zonocerous variegatus*	4	2	1	5	3	0	3	1	4	2.6%
Mistletoe (*Tapinanthusbangwensis)*				35						3.8%
Mosses	5			6					6	1.8%
Dryopteris	6	16				7		4	5	4.2%
Squirrels	4	5	7	5	4	6	4	3	5	4.8%

4. Osun State Pests Mapping

A:Survey of Atakumosa West LGA, Osun

Farm 1

Village: Awori

Latitude: 7’37’’13^{o}N

Longitude: 4’41’’46^{o}E

Diseases intercepted: Black pod

Pathogens intercepted: *Phytophthora* species

Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper

Weeds intercepted: Green carpet (*Mosses*)

Nematode population: 14

Farm 2

Village: Awori 2

Latitude: 7’21’’28^{o}N

Longitude: 4’99’’32^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Virus intercepted: Red vein banding on young cocoa flushes (CSSV suspected)
Weeds intercepted: *Dryopteris*, Green carpet (*Mosses*)
Nematode population: 145

Farm 3
Village: Aba Odole
Latitude: 7’36’’59^{o}N
Longitude: 4’41’’37^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 164

<u>B:Survey of Atakumosa East LGA, Osun</u>
Farm 1
Village: TemidireIwara
Latitude: 7’30’’1^{o}N
Longitude: 4’41’’54^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 114

Farm 2
Village: Iwara 2
Latitude: 7’30’’1^{o}N
Longitude: 4’41’’54^{o}E
Diseases intercepted: Black pod
Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Weeds intercepted: Green carpet (*Mosses*)
Nematode population: 54

Farm 3
Village: Olukiri Junction
Latitude: 7’30’’31^{o}N
Longitude: 4’42’’20^{o}E
Diseases intercepted: Black pod

Pathogens intercepted: *Phytophthora* species
Insects intercepted: Mirids, Stem borer, Termites, Pod husk borer & Grasshopper
Virus intercepted: chlorosis/ vein clearing on mature leaf
Nematode population: 22

C:Survey of Ayedade LGA, Osun
Farm1
Village: Agoowu 1
Latitude: 7’10’’17^{o}N
Longitude: 4’5’’50^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer, Psyllids & Grasshopper
Nematode population: 83

Farm2
Village: Agoowu 2
Latitude: 7’10’’20^{o}N
Longitude: 4’5’’57^{o}E
Diseases intercepted: Black pod, Cherelle wilt
Pathogens intercepted: *Lasiodiplodia*species
Insects intercepted: Mirids, Stem borer, Shield bug, Termites, Pod husk borer, Psyllids & Grasshopper
Nematode population: 50

Table2: Summary index of major cocoa pests in Osun State farms

Intercepted pest	Percentage (%) pest Incidence in all farm									Average
	Atakunmosa West			Atakunmosa East			Ayedade LGA			
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
Diseases										
Black pod disease (*Phytophthora megakarya*)	25	40	30	15	14	10	11	25		18.8%
Cherelle wilt							25	10		3.8%
Cocoa Swollen Shoot Virus Disease (CSSVD)		+				-	-			25%
Insect pests										
Cocoa mirids (*Sahlbergellasingularis*)	13	20	10	25	15	10	40	35	0	18.7%
Cocoa stem borer (*Eulophonotusmyrmeleon*)	0	0	0	3	2	1	7	10	0	2.6%

Termites *(Macrotermesbellicosus*)	7	15	9	7	14	10	15	20	0	10.8%
Shield bug (Bathycoeliathalassina)	0	0	0	0	0	0	5	3	0	0.9%
Pod husk borer *(Characomastictigrapta)*	5	7	10	6	4	7	16	13	0	7.6%
Psyllid *(Mesohomotomatessamanni)*	2	0	3	0	2	1	4	2	0	1.6%
Grasshopper (*Zonocerous variegatus*	6	5	3	7	4	2	8	6	0	4.6%
Other pests										
Mistletoe (*Tapinanthusbangwensis)*										
Mosses	50	30	50	25	28	-	-	-	-	20.3%
Dropteris			50							5.5%
Squirrels	5	7	3	6	4	5	4	2	5	4.6%

Conclusion and Recommendations

The farmers in most of the farms visited do not know about the CRIN Elite Cocoa varieties. They simply collect pods from their neighbors' or their plots to plant.Only very few of the farmers in all locations have got any form of assistance from the Government.There is therefore the need for CRIN to embark on aggressive training/sensitization programmes for the farmers as to encourage them.The government should set up processing industries in the various states for the utilization of the readily available cocoa beans in these farms.

References

Adeniyi, D.O. (2019). Diversity of cacao pathogens and impact on yield and global production. In *Theobroma cacao* – Science for sustainability of global cocoa economy, doi: 10.5772/intechOpen. 81993. pp. 43 – 62. Published in London, United Kingdom.

Brasier, C. M., and Griffin, M. J. (1979). Taxonomy of *Phytophthora palmivora*of cocoa. Trans. Br. Mycol. Soc. 72:111-143.

Deberdt, P., Mfegue, C. V., Tondje, P. R., Bon, M. C., Ducamp, M. and Hurard, C. (2008). Impact of environmental factors, chemical fungicide and biological control on cacao pod production dynamics and Black pod disease disease (*Phytophthora megakarya*) in Cameroon. *Biological Control* 44:149-159.

Ndoumbe-Nkeng, M., Cilas, C., Nyemb, E., Nyasse, S., Bieysse, D., Flori, A., and Sache, I. (2004). Impact of removing diseased pods on cocoa Black pod disease caused by *Phytophthora* megakarya and on cocoa production in Cameroon. Crop Prot. 23:415-424.

Opoku, I.Y., Akrofi, A.Y., Appiah, A.A., 1997. The spread of *Phytophthora megakarya* on cocoa in Ghana. In: Proc. 1st Int. Cocoa Pests and Diseases Seminar, Accra, Ghana, 6 to10 November, 1995.

Opoku, I.Y., Appiah, A.A., Akrofi, A.Y., Owusu, G.K., 2000. *Phytophthora megakarya*: a potential threat to the cocoa industry in Ghana. Ghana J. Agric. Sci. 33, 237e248.

Year of Report: 2021

Research Programme: Cocoa Programme

Title: CREATION OF AWARENESS AND DISSEMINATION OF CRIN DEVELOPED TECHNOLOGIES IN SELECTED COCOA GROWING COMMUNITIES IN CROSS RIVER STATE

Investigators: Uwagboe, E. O., Agbongiarhuoyi, A. E., Adedeji, A.R.

Abstract

Nigeria smallholder cocoa farmers are mostly engage in the marketing of raw cocoa beans to cocoa merchant who export the beans to the international markets. This practice has reduced the consumption of cocoa finished products and led to reduction in the revenue generated from cocoa production in the country. Multi-stage random sampling technique was used in the selection of the Local Government Areas, Communities and the cocoa farmers. The study reveals that majority (91.7%) of the farmers were male which implies that cocoa farming in the study area is largely dominated by male. Majority (46.7%) of the farmers were between 39 and 48 years old. The implication of this is that cocoa farmers in the LGAs are still in their productive years. Large proportion of the farmers in Etung and Ikom LGAs are not aware of Cocoa powder (91.7%), Cocoa Bread (90.1%), Cocoa wine (88.8%), Chocolate (86.9%), Liquid soap (89.4%), Black soap (87.5%), Cocoa cream (90.8%), Cocoa balm (94.2%). CRIN should continue with series of trainings on value addition to cocoa along the value chain and encourage farmers and other stakeholders in processing of cocoa to boost employment and revenue generation into the cocoa industry.

Introduction

Nigerian economy in the past decades depended greatly on agriculture as it provides employment opportunities for the teeming population and contributes to the growth of the economy (Oji-Okoro, 2011). The discovery of oil in the late 60's lead to a drastic shift from agriculture which was the central hub of Nigeria economy to crude oil production. Since the oil boom, agriculture, which was the major contributor to the Gross Domestic Product (GDP) of the country, has been relegated to the background (Jimoh, 2005).

Cocoa is a sub-sector in Nigeria's agriculture and it has been noted that it is capable of increasing not only per capita income; but can reduce spatial inequalities between rural and urban areas and reduce rural-urban migration (Abayomi, 2006**)**. Nigeria produce cocoa in fourteen out of its thirty six states and they are grouped into three categories according to their level of production. The groups are: higher producing states (Ondo, Cross River and Osun); medium producing states (Edo, Ogun, Oyo, Ekiti, Abia, Delta and Akwa-Ibom) and less producing states (Kwara, Kogi, Taraba and Adamawa)

Brief description of Cross River State

Cross River State is one of the 36 states of Nigeria. The present Cross River State came into being in September 1987 when the old Cross River State was split into Akwa Ibom and Cross River States. It is made up of parts of old Calabar and Ogoja Provinces divided into 18 administrative units' called Local Government Areas. The Local Government Areas include Obanliku, Obudu, Bekwara, Ogoja and Yala in the North Senatorial District, Boki, Ikom, Etung, Obubra, Abi and Yakurr in the Central District and Biase, Akankpa, Odukpani, Calabar Municipality, Calabar South, Akpabuyo and Bakasi in the Southern Senatorial District.). Out of a total of eighteen Local Government Areas (LGAs) in the state, fourteen (14) produce cocoa.

It lies between latitudes 5°32' and 4°27' North and longitudes 7°50' and 9°28' East. However, the Obudu and Obanliku Plateau with an altitude of 1,575.76 meters above sea level enjoys a climate typical of the temperate regions of the world National Population Commission (NPC) (2006).

Agriculture is the leading sector in Cross River State. It employs about 80% of the state's labour force, and contributes about 40% to the Gross Domestic Product (GDP). The most important cash crops are cocoa, coffee, cotton, bananas, rubber, palm oil and kernels and groundnuts. The main food crops are plantain, cassava, corn, millet and sugarcane. The state has modern agricultural estates and several smallholder farms in the local government areas. The climate allows growing a wide variety of crops. Export crops are the focus of agricultural production and research of the state with livestock, fishing and forestry as pillars of the economy.

In Cross River State subsistence farmers account for a greater proportion of cocoa farm holdings and they are the backbone of the agricultural sector in the state. The three Local Government Areas known to be the largest cocoa producing areas in the State are; Boki, Ikom and Etung.

Justification of the project

Nigeria smallholder cocoa farmers are mostly engage in the marketing of raw cocoa beans to cocoa merchant who export the beans to the international markets. This practice has reduced the consumption of cocoa finished products and led to reduction in the revenue generated from cocoa production in the country.

Some research surveys conducted by Cocoa Research Institute of Nigeria (CRIN), showed that many cocoa farmers are still unaware of the activities of CRIN Sub-station at Cross River state due to non-availability of processing unit at the station. The awareness of CRIN developed products is very low in some parts of the country which affects the value addition sector of cocoa value chain. There is need to investigate the level of awareness among farmers in the state in order to recommend ways to increase value addition and consumption to relevant stakeholders and policy makers. If there are gaps created by current practices of farmers, it is therefore necessary to create an awareness and sensitize cocoa farmers on the available technologies in CRIN for best global practices in cocoa procesing for sustainable production, improved livelihood and economic productivity to farmers in Cross River State.

Objectives

1. Identification of the cocoa growing communities in Cross River State

2. Introduction of CRIN Ajassor Sub-station to the cocoa farmers

3. Train the farmers on the activities of CRIN Ajassor Sub-station

4. Introduce some of the CRIN developed technologies to the farmers

5. Administer questionnaire to ascertain the level of awareness of some exhibited CRIN developed products

METHODOLOGY

Selection of locations and cocoa farmers

Four phases of selection was adopted in the selection of farmers in the project, in the first phase of the project, multi-stage random sampling technique was used in the selection of the Local Government Areas, Communities and the cocoa farmers. In stage 1: Two (2) Local Government Areas (LGAs) were selected. In Stage 2: Two (2) communities were selected based on contiguity and proximity to the farmers centers as follows**: Etung LGA**: Effraya

and **Ikom LGA** Akparabong, the selection of only two centers for the exhibition was due to paucity of fund.

In stage Three (3): Sixty (60) farmers were selected from five (5) communities around Effraya and Akparapong giving a total of five (120) cocoa farmers. A pre-visit for the legitimization of the project was carried out using village facilitators in all the communities before the actual execution of the project. In each community some CRIN developed technologies (Black soap, Cocoa Powder, Cocoa cream, Cocoa balm, Cocoa and Kola wine) were exhibited for farmers awareness and sensitization.

Results and Discussion

1.0 Socio economic characteristics of cocoa farmers in Etung and Ikom local government areas, Cross River State

Table 1 shows the socio-economic characteristics of cocoa farmers in Etung and Ikom Local
Government Areas (LGAs) of Cross River State. The table reveals that majority (91.7%) of the farmers were male. The implication of this is that cocoa farming in the study area is largely dominated by male gender and thus may be able to withstand the tasks of adopting value addition to cocoa produce by processing. Similarly, Girei et al (2013) reported that in Africa, men are more in a crop that is perceived to have commercial value. Majority (46.7%) of the farmers were between 39 and 48 years old. The implication of this is that cocoa farmers in the LGA are still in their productive years and thus cocoa production in the study area is expected to be on the increase for sustainable availability of raw materials for processing of cocoa products. However, this is not in consonance with the findings by Adeogun et. al (2010) and Adebiyi and Okunlola (2013) who reported that cocoa farmers in selected states of Nigeria were old and have passed their productive age.
Similarly, the table reveals that highest proportion (48.0%) of the farmers had access to secondary education. The implication of this is that the farmers may perhaps have access to information on value addition to cocoa along the value chain in respect to cocoa processing.

Table 1: Socio economic characteristics of the respondents

	Effraya LGA Sample size=60		Akparabong LGA Sample size=60	
Variables	Freq.	%	Freq.	%
Sex				

Male	55	91.7	53	91.7
Female	5	8.3	57	8.3
Age (Years) 39- 48 49 -58 Above 58	 28 19 13	 46.7 31.7 21.6	 30 17 13	 50.0 28.3 21.7
Educational Level Primary Secondary Tertiary	 17 29 14	 29.0 48.0 23.0	 11 37 12	 18.3 61.7 20.0

Source: Field Survey, 2021

3.0 Awareness of some CRIN technologies by farmers in Etung and Ikom Local Government Areas of Cross River State

Table 2 below revealed that very low proportion of the farmers were aware of some CRIN technologies exhibited. Some of the farmers that were aware could be attributed to attendance of training organized by CRIN which is a confirmation of positive impact the sub -station has made in the state. However, large proportion of the farmers in Etung and Ikom LGAs are not aware of Cocoa powder(91.7%), Cocoa Bread (90.1%),, Cocoa wine (88.8%), Chocolate (86.9%),, Liquid soap (89.4%), Black soap (87.5%), Cocoa cream (90.8%), Cocoa balm (94.2%) of the farmers has no knowledge. This is expected based on the unavailability of processing unit at CRIN Ajassor Sub-station. According to Adebola (2022), the federal and state governments are to encourage local consumption of cocoa as this will translate to economic benefit.

Table 2: Awareness of some CRIN technologies by the respondents

	Effraya % Sample size=60		Akparabong % Sample size=60	
Variables	Yes	No	Yes	No
Cocoa Powder	8.3	91.7	7.3	92.7
Cocoa wine	11.2	88.8	10.2	89.8
Cocoa Bread	9.9	90.1	9.7	90.3
Chocolate	13.1	86.9	12.5	87.5
Black soap	12.5	87.5	10.5	89.5
Cocoa cream	9.2	90.8	6.7	93.3
Cocoa Liquid soap	10.6	89.4	12.6	87.4
Cocoa Balm	5.8	94.2	7.8	92.2

Source: Field Survey, 2021

Conclusion and Recommendation

Based on the findings of this study, most of the CRIN technologies are not known by majority of the farmers who may be willing to invest in the processing of their produce into some of the products. CRIN should make these products available in large quantity to Cross River State to create awareness for interested investors and also establish processing unit at Ajassor Sub-station. Furthermore, CRIN should continue with series of trainings on value addition to cocoa along the value chain and encourage farmers and other stakeholders in processing of cocoa to boost more revenue generation into the industry.

References

Abayomi, F. (2006) An Overview of Nigerian Agricultural Sectors. Journal of Agricultural Economics, 8, 7-16.

Adebiyi S, Okunlola JO. Factors Affecting Adoption of Cocoa Farm Rehabilitation Techniques in Oyo State of Nigeria. World Journal of Agricultural Sciences. 2013;9(3):258-265.

Adebola,P. O. (2022) Nigeria should not rely on exporting cocoa alone. https://punchng.com/nigeria-should-not-rely-on-exporting-cocoa-alone-says-crin-ed/

Adeogun SO, Olawoye JE, Akinbile IA. Information source to cacao farmers on cacao rehabilitation tecniques (CRTs) in selected States of Nigeria. J. Media and Commun. Stud. 2010;2:009-015

Girei AA, Daura Y, Dire B. An economic analysis of groundnut (Arachis hypogeal) production in hong local government area of Adamawa State, Nigeria. Journal of Agricultural and Crops Research. 2013;1(6):84-89.

Jimoh A. (2005). "The malaria burden and agricultural output in Nigeria."Agrosearch Journal. 7(2): 43-50

Oji-Okoro, I., 2011, Analysis of the contribution of agricultural sector on the Nigerian economic development, World Review of Business Research, 1(1), 191 – 200.

Report of Nigeria's National Population Commission on Census (2006) Population and Development Review: Vol. 33, No. 1 (Mar., 2007), pp. 206-210 https://www.jstor.org/stable/25434601

2021 RESEARCH REPORT

RESEARCH PROGRAMME: Cocoa

Title: "On-Farm Demonstration of CRIN Liquid Soap to farmers in 2 locations in Southwestern Nigeria toward sustainable livelihood".

Investigators:Yahaya L.E, Adedeji A.R, Adebiyi S.

Introduction:Cocoa cultivation remain one of the major agricultural practices in the South western part of Nigeria. This has always been a source of income to the farmers that engage in this practice. However, most of these farmers are peasant and most often generate little from their cultivation due to small size farming. Also, women are equally involved in the cocoa business and as such will have to engage in other farming practices that will support what they already have. Soap production is one of such practices that can be involved in and that will generate revenue to the would-be- investor. One of the raw material, Cocoa pod husk is readily available on the farm which often liters the entire farm. The training was carried out to help farmers to diversify into soap production and be able to generate income for them and consequently sustaining their living. This training has aslo helped to clean up the farm environment, hence reducing pathogenic host which would been caused by heaps of rotten cocoa pod husks.

Materials and Method: Farmers were trained on soap production using cocoa pod husk. This was done using the participatory approach method. The saponification process as modified by Yahaya *et al*, 2004 for soap production was employed while involving the farmers in the production process. Farmers were made to participate in the training so that they can have mastery over the process of production and were able to take up the skill at the end of the training.

Results and Discussion: At the end of the training session, participants were fully acquainted and equipped with the method and skills of producing liquid soap using cocoa pod husks. They were also happy to have received the training on soap production using a seemingly waste material. Many among the participants promised to take up the technology as a means of livelihood.

Conclusion and Recommendation: It was practically obvious that soap training among cocoa farmers is possible. It was a fruitful experience among the participants. It is therefore recommended that this type of training should be extended to other cocoa producing areas to maximize the value addition of their crop.

References:

1.Yahaya, L.E; Hamzat, R.A, Aroyeun, S.O and Odufuwa, M.I, (2002). Production of liquid detergent from the pod husk of kola (Cola nitida) Moor Journal of Agricultural Research. 3, 253-256

2.Wilkinson, R N (1974).” Detergents” in chemicals and process technology Encyclopedia. McGraw Hill, New York.

2021 Research Report
Cocoa Research Program

Diagnostic Survey of Organic Cocoa Production in Nigeria and Selection of Conventional Cocoa plantations for Conversion to Organic

Ogunlade M.O., Adedeji A.R. Oyedokun V.A., Adejobi K.B, Oluyole K.A, Famuyiwa B. and Olasupo Festus

Introduction

Consumers’ consciousness about the safety of what they consume and the increased awareness of the need for safety of the environment has brought organic cocoa production into the limelight. Organic cocoa is a bit more acidic and bitter (astringent) than normal cocoa. Organic cocoa is (mainly) used by premium chocolate brands to make chocolates. It is

also used in personal care products as organic cocoa contains nutrients such as minerals, vitamins, antioxidants and other essential analogues which are beneficial for maintaining a healthy skin. Demand for premium chocolate brand by consumers is increasing which is in turn escalating the demand for organic cocoa

Consumers are fond of chocolates but they are also conscious about their health which allows these chocolate brands to manufacture chocolate using organic cocoa. Consumers are demanding for natural chocolates without the use of any chemicals and artificial ingredients. Due to this, there is an increasing growth of organic cocoa market.

Nigeria has great potential for exploiting organic cocoa market as there is large market demand for organic cocoa in developed countries especially in Europe and America.

This study aimed at

e. determining the status of organic cocoa production in Nigeria
f. producing organic cocoa by:

vii. Converting cocoa plantation from conventional to organic farming
viii. New establishment of organic cocoa while ensuring compliance with requirements of organic certification with a view to extend the technology to Nigerian cocoa farmers.
ix. Improving the income and sustainable livelihood of an average cocoa farmer in Nigeria

Methodology

Diagnostic survey

The survey was conducted in three Southern States in Nigeria. The States were Ondo, Oyo and Cross River States. In each of the States, three cocoa producing cocoa producing local government areas (LGAs) were purposively selected for the study. In each of the chosen LGAs, one community was selected thus making a total of nine communities chosen for the study. A total of 172 respondents were randomly selected for the study. Information was collected from the respondents with the use of structured questionnaire. The data retrieved from the information collected were analysed using descriptive statistics.

Selection of conventional cocoa plantations for conversion to organic cocoa farm

One cocoa plantation at CRIN Headquarters located at Zone 9 with Latitude 7.21348833 and longitude 3.854928 was selected. Ten core soil samples were collected randomly from the selected plot at two depths of 0-20cm and 20 - 40cm. The core samples were bulked into two composite samples for each of the depth. In Owena, a cocoa plantation located within latitude 7.201258333 and longitude 5.026525 was selected. Ten core soil samples were also collected randomly at two depths and bulked int two composite samples.
The soil samples were air dried under room temperature, sieved through 2mm sieve and sent to the laboratory for routine analysis using standard laboratory methods.

Results and Discussion

Table 1 shows the socioeconomic characteristics of the respondents. The Table shows that majority (80.2%) of the respondents were males while 46.5% of the respondents were above 50 years of age. The Table also shows that majority (72.7%) of the respondents were having formal education. This is a good indication as most farmers would be able to read instructions.

Table 1. Socioeconomic characteristics of the farmers

Variables	Frequency	Percentage
Age of farmers (years)		
≤ 30	20	11.6
31-40	29	16.9
41-50	43	25.0
51-60	30	17.4
>60	50	29.1
Total	172	100.0
Sex of farmer		
Male	139	80.2
Female	33	19.2
Total	172	100.0
Educational status of the farmer		
No formal education	47	27.3
Primary education	46	26.7
Secondary education	54	31.4
Tertiary education	25	14.5
Total	172	100.0

Marital status		
Single	11	6.4
Married	156	90.7
Widow	5	2.9
Total	172	100.0
Nature of ownership of the farm		
Inherited	74	43.0
Purchased	74	43.0
Rented	12	7.0
Sharecropping	12	7.0
Total	172	100.0
Membership of socio-economic group		
Member	129	75
Non-member	43	25
Total	172	100.0

Source: Field survey, 2022

Table 2 shows that 61.1% of the farmers did not know about organic cocoa production while 34.9% claimed that they know organic cocoa production. However, 25% of those that claimed that they know about organic cocoa production got the information from CRIN. 93% of the respondents did not have organic cocoa farm.

Table 2. Status of organic cocoa production

Variables	Frequency	Percentage
Do you know about organic cocoa production?		
Yes	60	34.9

No	112	65.1
Total	172	100.0
If yes, from which source?		
CRIN	43	25.0
ADP	2	1.2
Farmer's Field School (FFS)	6	3.5
Television	1	0.6
Family friends	5	2.9
No response	115	66.9
Total	172	100.0
What is your understanding about organic cocoa production?		
Production of cocoa without using any chemical	88	51.2
Production of cocoa with exclusive use of chemicals	6	3.5
Production of cocoa with the use of both chemicals and botanicals	8	4.7
No response	70	40.7
Total	172	100.0
What do you think is the benefit derivable from organic cocoa production?		
Farmers are less exposed to chemical hazards	34	19.8
Soil ecology is conserved naturally	7	4.1
Increase in cocoa yield	4	2.3
Premium price	3	1.7
Produce devoid of chemical contaminations	1	0.6

All of the above	50	29.1
No response	73	42.4
Total	172	100.0
Do you have organic cocoa farm?		
Yes	12	7.0
No	160	93.0
Total	172	100.0

Source: Field survey, 2022

The soils of the two sites were slightly acidic ranging from 6.31 to 6.54 as shown in Table 3. Organic carbon and nitrogen contents of the soils were very low. Available phosphorus, exchangeable potassium and calcium of the soils of the two sites were also low and below the soil critical value for cocoa. Considering the low soil fertility status of the selected sites, organic amendment using organic fertilizer will be required to boost the productivity of the selected plantations while converting them to organic farms.

Table 3: Cocoa Plantations selected for conversion to Organic cocoa plots at Ibadan and Owena

Soil Properties	Ibadan	Owena
pH	6.31	6.54
Organic Carbon(g/kg)	0.096	0.109
N (g/kg)	0.011	0.01
P(mg/kg)	4.79	5.4
K(cmol/kg)	0.09	0.28
Ca(cmol/kg)	2.60	2.35
Mg(cmol/kg)	0.57	0.65
Na(cmol/kg)	0.30	0.35
Al+H(cmol/kg)	0.11	0.08
ECEC(cmol/kg)	3.66	3.72

Base Saturation (%)	97.00	97.85
Mn (mg/kg)	13.55	35.60
Fe(mg/kg)	31.75	25.70
Cu(mg/kg)	0.74	1.08
Zn(mg/kg)	2.69	2.43
Sand (%)	752	812
Silt (%)	174	134
Clay (%)	74	54
Textural class	Sandy loam	Loamy sand

2021 Extension Activities Report

Dissemination of CRIN Developed Technologies among end-users in Lagos State

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Introduction

The Cocoa Research Institute of Nigeria (CRIN), over the years developed a lot of technologies from her mandate crops. Some of these technologies are on shelf and needs to be extended to end-users in Nigeria through exhibition, training, demonstration, radio, television and workshop. Agricultural research technologies are essential inputs in agricultural education, research, development and extension services. To a great extent, agricultural development depends on the successful implementation of disseminated agricultural research information to farmers, processors, marketers, consumers and the general public Mubofu (2017). A critical assessment of the extent of utilization of these technologies will help ensure improvements where necessary. CRIN technologies help to provide income, job creation, food and nutrition security of the country. This is very much in line with the diversification agenda of the Federal Government from the oil to non-oil sector in Nigeria. It was a one-day event which was held on 23 March, 2022 at Jara Mall Ikeja, Lagos.

Objective

The major objective was to extend some CRIN developed technologies to end users in Lagos State. The specific objectives were to exhibit and promote CRIN developed technologies to end-users.

Methodology

The project was carried out in Jara Mall Ikeja, Lagos State of Nigeria. Lagos State was purposively selected because of its commercial nature and CRIN technologies had earlier been introduced tosome traders and Extension agents. Participants were selected from traders within and outside Jara Mall premises with the help of the manager of the organization.

Representative of ADP Extension agents were also involved in order to further disseminate the information to farmers. Also, Lagos Agricultural Development Authority (ADA), Agribusiness, business men and women and the commissioner for Agriculture who was ably represented by the Director of Agribusiness were invited to be part of the event.
The CRIN developed technologies that were exhibited during the programme were Cocoa bread, Cocoa powder, Liquid soap, cashew kernel, Chocolate, Cocoa wine, Kola wine, Coffee wine, Cashew wine and Tea wine.

Results and Discussion
Activities of the programme

3. Introduction of guests and media practitioners

The programme was attended by many dignitaries including commissioner for agriculture, Lagos State who was represented by the State Director of Agric business, Mrs Aramide Dansalu, an Extensionist from Nigeria Institute of Oceanography and Marine Research(NIOMR), Dr Gloria Ikeyoweto Omogho, Acting Director of extension service, Lagos State Ministry of Agriculture and Rural Development, Mrs Ebota Olusola official of radio Nigeria Lagos branch, News agency of Nigeria among others.

4. Opening remarks by CRIN

The Executive Director, CRIN, Dr. Patrick Adebola in a remark stressed on the importance of the products, saying their health benefits ranged from reducing hypertension, curing diabetes as well as serving as antidote to malaria symptoms and boosting the brain function. ED charged investors to take up the responsibility of mass production to further increase the volume of the nation's agro products for export and for local consumption thereby enhancing the economy. He said "The Cocoa Research Institute of Nigeria (CRIN) was established in 1964 to carry out research and development on five major crops which are cocoa, kola, coffee, cashew and Tea. He emphasized the reasons for displaying products from CRIN mandate crops. The intention is to disseminate this to the community and to Nigerians in general to see if there are investors that will be interested in coming to take up these technologies that have been in our shelves

7. Brief speech from the Hon. Commissioner for Agriculture, Lagos State

The Lagos state Hon. Commissioner for Agriculture, MrsAbisolaOlusanya who was represented by Director of Agric Business, MrsAramideDansalu explained that the value addition on the affected crops would bring about increased job and wealth creation for Nigerians, in addition to addressing nutritional deficiencies among both children and adult citizens .She added that, "the expansion of the value chain is good as it will bring about value addition to what we produce and that the research products , particularly those from CRIN would go a long way in bringing the commodity to consumers while promising that she will visit CRIN and make sure they take these products to farmers . She appreciated CRIN for bringing such programme to Lagos and that Lagos State is ready to partner with CRIN.

8. Introduction of CRIN Developed Technologies/ Products to the public.

The Head of Extension Section CRIN, Mr Anthony Agbongiarhuoyi stated the institute was given five mandate crops by the Federal Government these crops are Cocoa, Kola, Coffee, Cashew, and Tea. He stressedthe products from the mandate crops which are Cocoa bread, Cocoa wine, Coffee wine, Tea wine, Cashew wine, Cocoa powdered, Liquid soap, milk chocolate among others. He called on the Lagos State government to adopt some of the products for its school feeding programme, explaining that a particular product from cocoa

contains the needed nutrients that boost brain power and that if used in feeding school children could enhance their ability to learn.

9. Testing of CRIN Products

Cocoa bread was cut into smaller sizes and distributed to all the participants, wines from all our mandate crops was served as well. Cocoa powdered beverages with milk and sugar was served. Also, raw cocoa powdered beverage was prepared. The participants tested all our products. They later told us about what they observed.

10. Feedback from the participants

The participants commented that the wax in the body cream and balm must be increased to prevent it from being melting easily.
They said the level of alcohol in tea wine was too high.
They cocoa powered beverage was too bitter
CRIN should improve on the packaging of our products.

Media coverage: The event was adequately covered by Federal Radio Corporation of Nigeria (FRCN) Lagos, Punch Newspaper, KAFTAN online Television and Lagos City News. The links are enclosed for your listening and viewing.

4. https://www.buzzministry.com/2022/03/24/crin-sensitises-lagos-public-on-20-research-products-from-cocoa-others/

5. https://punchng.com/nigeria-should-not-rely-on-exporting-cocoa-alone-says-crin-ed/

6. www.kaftan.tvhttps://youtu.be/C-JwwLVrs_Y

Photo speaks

Products' Banner

Representative of the Hon Commissioner, Lagos State

CRIN products displayed

Cross section of Participants and invited guests at the event

Closing Remarks: The head of Extension appreciated the participants and invited guests for honoring the invitation to attend the programme. The event came to an end around 4:30 pm.

Conclusion and Recommendation

The event was successful and created lagosians the opportunity to be aware and use CRIN developed products. This was the first of its kind in Lagos State. Participants expressed willingness and interest in up taking some of the products. The Lagos State Government was particularly interested in taking the cocoa powder consumption for school feeding programme due to its health benefits. The representative of the honorable commissioner for agriculture told reporters that Lagos State government was ready to partner with CRIN in utilizing CRIN products which could enhance local processing, create job opportunities, provide income and improve food and nutrition security. The participants appealed to CRIN to make the products available in the market so that people can have access to them.

Reference

Mubofu, C. (2017). Disseminating Agricultural Research Information: A case study of farmers in Mlolo, Lupalama and Wenda villages in Iringa district, Tanzania. University of Dar es Salaam Library Journal, Vol 12, No 2 (2017), pp-80-97.

2021 RESEARCH REPORT

RESEARCH PROGRAMME: Cocoa

Title: “On-Farm Demonstration of CRIN Liquid Soap to farmers in 2 locations in Southwestern Nigeria toward sustainable livelihood”.

Investigators:Yahaya L.E, Adedeji A.R, Adebiyi S.

Introduction:Cocoa cultivation remain one of the major agricultural practices in the South western part of Nigeria. This has always been a source of income to the farmers that engage in this practice. However, most of these farmers are peasant and most often generate little from their cultivation due to small size farming. Also, women are equally involved in the cocoa business and as such will have to engage in other farming practices that will support what they already have. Soap production is one of such practices that can be involved in and that will generate revenue to the would-be- investor. One of the raw material, Cocoa pod husk is readily available on the farm which often liters the entire farm. The training was carried out to help farmers to diversify into soap production and be able to generate income for them and consequently sustaining their living. This training has aslo helped to clean up the farm environment, hence reducing pathogenic host which would been caused by heaps of rotten cocoa pod husks.

Materials and Method: Farmers were trained on soap production using cocoa pod husk. This was done using the participatory approach method. The saponification process as modified by Yahaya *et al*, 2004 for soap production was employed while involving the farmers in the production process. Farmers were made to participate in the training so that they can have mastery over the process of production and were able to take up the skill at the end of the training.

Results and Discussion: At the end of the training session, participants were fully acquainted and equipped with the method and skills of producing liquid soap using cocoa pod husks. They were also happy to have received the training on soap production using a seemingly waste material. Many among the participants promised to take up the technology as a means of livelihood.

Conclusion and Recommendation: It was practically obvious that soap training among cocoa farmers is possible. It was a fruitful experience among the participants. It is therefore recommended that this type of training should be extended to other cocoa producing areas to maximize the value addition of their crop.

References:

1.Yahaya, L.E; Hamzat, R.A, Aroyeun, S.O and Odufuwa, M.I, (2002). Production of liquid detergent from the pod husk of kola (Cola nitida) Moor Journal of Agricultural Research. 3, 253-256.

2.Wilkinson, R N (1974).” Detergents” in chemicals and process technology Encyclopedia. McGraw Hill, New York.

YEAR OF REPORT: 2021

KOLA RESEARCH PROGRAMME

CAPACITY BUILDING FOR KOLA FARMERS ON GOOD AGRICULTURAL PRACTICES (GAPS) IN OKUKU, ODO-OTIN LOCAL GOVERNMENT AREA OF OSUN STATE,

Investigators; Abdul-karim, I. F., Adebiyi, S., Ayegboyin, K. O., Williams, O. A.

Introduction:

Kola nut is a tropical tree crop with over 20 species, out of which Cola nitida (Gbanja) and Cola acumulata (Abata) are the two main species grown in Nigeria. Cola nitida however is the only kola nut of inter-regional and international trade. While the consumption of cola acumulataia greatly cherished by the Yoruba of south west of Nigeria; the people of the northern and south west Nigeria prefer the Cola nitida. The commodity gets very significance attention during marriage and burial ceremonies and even during every entertainment of important visitors where it is offered as valuable gift on such important occasions. In addition to the economic and social important of kola nut, it enjoys special favour with the people of northern Nigeria, who have accepted the Cola nitida as a stimulant substitute for alcoholic drinks. In the middle belt of northern Nigeria, women were the major marketers of kola nut while in northern part men carried out marketing and all other activities in kola nut.

Every year, an increasing numbers of Nigerians earn their living as kola nut producers, transporters traders, middlemen and even as professional packing men and is the third most important among the words stimulants whose production covered about 47 million metric tones in 1985 (Michael,1985).

There is a high level of inconsistency and fluctuation in the kola nut which is not entirely resulting fall in production it is in the light of the above this study is need to be carried out as a research as capacity building for kola farmers on Good Agricultural Practices (GAPs) in Okuku Community, Odo-otun Local Government Area of Osun State.

Objective of the study to;

- Empower kola farmers on capacity building on GAPs in the study area,
- Increase and improve kola nut production,
- Improve the livelihood of the farmers in the study area.

Justification;

Due to high level of inconsistency and fluctuation in the production of kola nut which is not entirely from fall in production of the product and women were the major active participate in kola nut trading and activities in some part of the country, with ways of improving the living standard of kola

nut marketers and livelihood of those women partake in purchasing and marketing of the product, in the light of the above, this study is intending to be carried out capacity building for kola farmers on Good Agricultural Practices (GAPs) in Ondo State.

Materials and Methods;

The study was carried out in three local government areas of Osun State respectively. Purposively and multistage random sampling was used to select 120 participant in the training of capacity building on good agricultural practices in the study.

 Stage 1; three local government areas were purposively selected for high participation in the kola nut production in each study areas.

 Stage 2; three communities/villages were chosen in each of the three local government area selected to give nine areas for the study in the state, also in each of the community/village 40 fruity participant in kola nut GAP training were randomly selected to give a total of one hundred and twenty (120) respondents for the study in the state. The data for the study were collected with the use of structured interview schedule and analysis with the use of descriptive; frequency count means and simple percentage were used.

Result and Discussion

The training on agronomy practices was disseminated by an expert from agronomy department of Cocoa Research Institute of Nigeria, (CRIN) Ibadan. The GAPs training on kola production was carried out in March, 2022 on the farmers' farm for easy assimilations and adequate understanding of some terms used during the training. Almost 50 kola nut farmers or respondents attended the training.During the training some of the topics treated are: selection of good site for kola production, test for soil fertility, soil testing, preparation of land for kola production, viable seeds/seedlings, biography of the seeds used for planting, planting distance i.e. spacing, planting pattern (nursery or planting inshitue or direct planting of kola nut), adequate maintenance of the farm,supplying, pruning, pest and diseases control, use of organic fertilizer, removal of mistitles among others.

The subject matter specialist further encouraged and instructed the kola farmers' to form themselves into cooperative group, this will enable them to get loan from the government or any assistance from both government and non-governmental body which may eventually assist the farmers in improving their standard of living as well as increase their production.

Some scientists from extension division of CRIN contributed to the training by taking the farmers to the memory line, telling the farmers how kola nut become parts of Okuku community, advantages of kola nut to people in Okuku, importance of kola nut to nation, health benefits of kola and usefulness of kola to individual and government as a whole. More so, the farmers where made to understand that the white men had developed an interest on Okuku kola and they are ready to partner with the farmers if all the GAPs training is been followed strictly and produce good quality and quantity kola.

Farmers in the areas were very delighted and commend CRIN for bringing the training to their local government and assuring the CRIN that they were there for the institute any time their services is needed.

Summary and Conclusion

The training was well coordinated, the farmers' assimilation during the training was very good through some question asked the farmers' after the training while the respond to the questions was very perfect and the farmers were delighted for been part of the trainee. More of such training should be organized in future to improve the kola farmers' awareness and experience on kola production.

Challenges (if any)

Poor road problem, bad condition of vehicle used, improvement on sensitization on CRIN as some communities or villages did not aware of CRIN existence. Enlighten people on radio and television on CRIN activities in the six geopolitical states.

Status (on-going or concluded)

Concluded

Future plans (if any)

Impact Assessment of Farmers on GAPs Training on kola in Osun State.

YEAR OF REPORT: 2021 RESEARCH REPORT
RESEARCH PROGRAMME: KOLA PROGRAM
TITLE: EFFECTS OF DRYING METHODS ON THE PROXIMATE AND PHYTOCHEMICAL COMPOSITIONS OF *COLA NITIDA*

Investigators: Olorundare, B.O., Jayeola, C.O., Ogunsowo, A.O., Adesanya, A.K., Akinola, O.C., Aremu-Dele O. and Adebiyi, O.S.

Introduction: Kola nut, a major caffeine-containing nut belongs to the plant family Sterculiaceae with about 125 species of trees native to the tropical rainforests of Africa. However, the most common of these species in Nigeria are *Cola nitida* (gbanja) and *Cola acuminata* (abata) (Adebayo and Oladele, 2012). Aside the nut's high caffeine contents, *Cola nitida* is reportedly known to contain other useful constituents such as theobromine, sugars, essential oils, alkaloids and many others (Asogwa *et al*., 2006). Over time, the bioactive constituents, phytochemicals and antioxidant properties of the kola nuts have been of keen interest to researchers in food and pharmaceutical industries. This owes to the fact that such components and properties are actively responsible for their medicinal importance.

Actually, the bioactive and biochemical properties of food have been reportedly revealed to be altered by several food processing methods thus causing a desirable or non-desirable change (Hassan *et al*., 2007). Notably, drying, a food processing method remains one of the post-harvest processing methods of kola nuts.

Kola nuts can be consumed or used in fresh or dried form. Fresh kola nuts are often consumed as a masticatory (Lowor *et al*., 2010) while dried kola nuts are mostly used in the production of kola nut powder and beverages. Drying is a major unit operation in kola nut processing that aids handling and preservation of the nuts by reducing its moisture content hence preventing deterioration by microorganisms and enzymes activities (Akinoso *et al*., 2014). While drying plays an important role in kola nut post-harvest processing, it is pertinent to employ the best and safest drying method that will conserve its bioactive and phytochemical constituents thus preserving their medicinal, nutritional and pharmaceutical properties. Despite the fact that drying is a key post-harvest processing and handling method of kola nuts, however, there is scanty information in literatures on its effect on the bioactive constituents of the nuts. Hence, this study was designed to assess the effect of drying methods on the proximate compositions and phytochemical properties of *Cola nitida* and to identify the most effective drying method(s) for the conservation and preservation of these bioactive components.

Materials and methods

Sample collection and preparation

Fresh kola nuts (*Cola nitida*) samples were purchased from Oke Otin farm, Okuku village, Odo Otin LGA, Osun State, Nigeria. The *Cola nitida* samples were sorted and divided into four portions for drying.

Cola nitida processing and drying

Cola nitida seeds were dried to a constant weight by four different methods: air-drying at room temperature (AID), solar-drying (SOD), oven-drying (OVD) and sun-drying (SUD). Air-drying of *C. nitida* was done at room temperature in a dark and well-ventilated room for a period of two weeks. The solar-drying took place in a solar chamber for 7 days while oven-drying was conducted in a hot-air oven at 65°C for 48 hours, the sun-drying was carried out by exposing the nuts to sun light for three days. After drying, all the dried samples were milled into fine particles, put in air-tight bottles and stored at -4^{o}C for subsequent analyses.

Proximate Analysis: The moisture and total ash contents were determined gravimetrically according to the methods ofAOAC 930.15 (2000) andAOAC 984.02 (2000) respectively. Crude protein content was determined by kjeldahl method whereby nitrogen content of the sample was digested using sulphuric acid in the presence of catalyst to covert sample nitrogen to ammonium sulphate. The acid solution was made alkaline with 40% sodium hydroxide solution. The ammonia was distilled and collected in excess of boric acid solution, followed by titration with sulphuric acid solution. The protein content was calculated using conversion factor of 6.25 (AOAC 984.13, 2000). Crude fat content was determined by the method of AOAC 920.39 (2000) while the evaluation of crude fiber was performed by filtration method (AOAC 978.10, 2000). Herein, the sample after defatting with acetone was sequentially boiled with 1.25% acid followed by 1.25% alkali after which the residue was then dried in the oven at 130^{o}C for 2hrs.

Phytochemical Analysis

Total phenols: Total phenols were extracted using acidified methanol and quantified by the Folin-Ciocalteu reagent method. Using UV spectrophotometer, the absorbance was read at 765nm and expressed as tannic acid equivalents mgkg^{-1} (Singleton *et al*., 1999).

Total Tannins: Tannin content was determined spectrometrically by the method of Hargerman *et al*. (2012) using folin-coicalteu reagent. The sample's tannin content was calculated after measuring the absorbance at 725 nm against the blank solution and the result was express as g/100g (Hargerman *et al*., 2012).

Alkaloids: Alkaloids were quantitatively determined according to the methods of Harborne (1973) and Sheikh *et al*. (2013). The contents were extracted with 10% acetic acid. The extract was concentrated on a water bath to one-quarter of the original volume followed by addition of few drops of concentrated ammonium hydroxide until the precipitation was complete after filtration, the precipitates were

washed with 20 cm^3 of 0.1 M of ammonium hydroxide and then filtered, the residue was dried in an oven and the percentage alkaloid was expressed mathematically.

Results and Discussion

The proximate compositions of *cola nitida* seeds after exposure to various drying methods are presented in Table 1. The moisture content of the samples significantly varied in respect to drying methods with solar-dried sample having the lowest moisture content of 7.00 % followed by sun-drying (8.30 %) then air-drying (8.85 %) while the oven-dried *cola nitida* has the highest moisture value of 9.15 %. The solar-dried sample which was with the lowest moisture content has the highest fiber content, followed by oven-dried, sun-dried and air-dried samples. A marked reduction in protein content was observed in oven-dried and air-dried samples when compared with that of solar and sun-dried *Cola nitida*. The decreased protein contents observed in oven-dried samples correlates with the report of Devi *et al*. (2019) and this could be ascribed to the ability of the oven to accumulate energy which could in turn cause some protein denaturation in dried samples (Hassan *et al*., 2007). However, the reduced protein content in air-dried samples could be due to enzymatic degradation resulting from increased period of drying at room temperature. Furthermore, the different drying methods except oven-drying have no significant effect on the ash contents of *Cola nitida* as there was no significant difference in their values which ranges from 2.82 to 2.90 % although, oven-dried *Cola nitida* has an ash content value of 2.61 %. Also, a remarkable difference was observed in the crude fat and carbohydrate (CHO) values on exposure to the drying methods with oven-drying and air-drying methods having the highest fat and CHO values respectively.

The results of proximate analysis obviously revealed that drying methods influenced the proximate compositions of *Cola nitida*.

In addition to the proximate analysis, the effects of these drying methods on phytochemical compositions of *C. nitida* was also evaluated. The results as presented in Table 2 revealed that the four drying methods used SOD, AID, SUD and OVD affected the phytochemicals, namely, alkaloids, tannins and total phenols in a similar manner, although with slight differences. These phytochemicals which are natural antioxidants are natural disease preventing, health promoting and anti-ageing substances (Ozyurt *et al*., 2004). Apparently from the result, *C. nitida* that underwent air-drying has the highest values of tannins and phenols followed by sun drying, oven drying and solar drying. In the same vein, the highest value of alkaloids was also observed in air-dried *C. nitida*, although, this was followed by SOD, SUD and OVD. Notably, this observation is in accordance with the report of Irondi *et al*. (2013) who observed that air-drying of *Carica papaya* seeds preserve the total phenols and tannins constituents better than sun drying and oven drying. The reduction in the levels of tannins and phenols by SUD and OVD could be attributed to oxidation of these bioactive compounds by high temperatures according to the reports of Yoshioka and co-authors (Yoshioka *et al*., 1990).

Conclusion

The different drying methods considered in this study influenced both the proximate and phytochemical compositions of *Cola nitida* seeds. General trend of results in proximate analysis showed that better nutrient retention was found in solar and sun-dried *C. nitida* than in air and oven-dried nuts. Hence, either solar drying or sun drying can be opted for as processing methods when proximate composition is under consideration. However, the analysis of phytochemicals apparently revealed that air-drying efficiently preserved the bioactive components that is phenols, tannins and alkaloids of *C. nitida* seedstherefore for effective preservation of these bioactive constituents, air-drying method of drying *Cola nitida* seeds may be most preferred however, the drying rate is slow.

Table 1: Effect of drying methods on Proximate Composition of *Cola nitida* seeds

	AID	SOD	SUD	OVD
Moisture (%)	8.85	7.00	8.30	9.15
Fat (%)	0.59	0.64	0.76	0.85
Protein (%)	8.00	8.81	9.68	8.69
Fiber (%)	1.81	3.63	2.11	2.36
Ash (%)	2.82	2.89	2.90	2.61
CHO (%)	77.93	77.03	76.25	76.34

•AID – Air drying SOD – Solar drying SUD – Sun drying OVD – Oven drying

Table 2: Effect of drying methods on the Phytochemical Composition of *Cola nitida* seeds

	AID	SOD	SUD	OVD
Alkaloids (%)	3.15	2.93	2.59	1.75
Tannins (gTAE/kg)	124.85	37.42	101.21	62.25
Phenols (g/kg)	151.11	64.20	150.94	101.11

AID – Air drying SOD – Solar drying SUD – Sun drying OVD – Oven drying

References

Adebayo, S.A. and Oladele, O.I. (2012). Medicinal Values of Kolanut in Nigeria: Implication for Extension Service Delivery. *Life Science Journal*;9(2):887-891.

Akinoso, R., Aremu, A.K. and Balogun, I.S. (2014). Some physical properties of kola nuts

response surface approach. *International Agrophysics*; 28:251-255.

AOAC 920.39. (2000). Fat (crude) or ether extract in animal feed Gaithersburg, MD, USA.

ISO 6492.

AOAC 930.15 (2000). Moisture in feed, loss on drying Gaithersburg, MD, USA. ISO 6496.

AOAC 978.10 (2000). Animal feeding stuffs – determination of crude fiber content. ISO 6865.

AOAC 984.02 (2000). Ash of animal feed Gaithersburg, MD, USA. ISO 5984. 2002 Animal feeds stuffs- determination of crude ash. Geneva, Switzerland.

Asogwa, E.U., Anikwe, J.C. and Mokwunye, F.C. (2006) "Kola production and utilization for economic development," African Scientist, 7(4): 217-222.

Devi, C.B., Bains, K. and Kaur, H. (2019). Effect of drying procedures on nutritional composition, bioactive compounds and antioxidant activity of wheatgrass (*Triticum aestivum* L), *Journal of Food Science and Technology*; 56(1):491-496.

Harborne, J.B. (1973). Phytochemical methods, 1st edn. Chapman and Hall, London, p 273

Hargerman, A., Muller, I. and Maker, H. (2000). Quantification of Tannins Laboratory manua, Vienna FAO/IAEA, p.4-7.

Hassan, S.W., Umar, R.A., Matazu, I.K., Maishanu, H.M., Abbas, A.Y. and Sani, A.A. (2007). The effect of drying method on the nutrients and non-nutrients composition of leaves of Leptadenia hastata (Asclipiadaceae). *Asian Journal of Biochemistry*; 2:188-192.

Irondi, A.E., Anokam, K.K. and Ndidi, U.S. (2013). Effect of drying methods on the phytochemical composition and antioxidant activities of *Carica papaya* seed. *International Journal of Biosciences*; 3(11):154-163.

Lowor, S.T, Aculey, P.C. and Assuah, M.K. (2010). Analysis of some quality indicators in cured *Cola nitida* (Vent), *Agriculture and Biology Journal of North America*;1(6): 1206-1214

Ozyurt, D., Ozturk, B.D. and Apak, R. (2004). Determination of total flavonoid content of Urtica dioica L. by a new method. Adnan Menderes University, 4 th AACD Congress, Turkey, Proceedings book.

Sheikh, N., Kumar, Y., Misra, A.K. and Pfoze, L. (2013) "Phytochemical screening to validate the ethnobotanical importance of root tubers of Dioscorea species of Meghalaya, North East India," *Journal of Medicinal Plants Studies*, 1:62-69.

Singleton, V., Orthofar, R. and Lamuela-Raventos, R.M. (1999). Analysis of total Phenols and other oxidation substrates and antioxidants by means of Folin ceocalteus reagent. *Methods in Enzymology*; 299.

Yoshioka, H., Tsuyumu, S. and Takayanagi, K. (1990). Radical formation during the processing of green tea. *Agricultural and Biological Chemistry*; 54:203-204.

2021 RESEARCH REPORT
PROGRAMME: KOLA
TITLE: PARTICIPATORY DIAGNOSTIC SURVEY OF CONSTRAINTS TO YOUTH INVOLVEMENT IN KOLANUT PRODUCTION IN OSUN STATE

Team: Williams OA, Orisajo SB, Adebiyi S and Abdulkarim IF

Introduction

Kola nut is an important economic cash crop, to a significant proportion of Nigerian population who are involved in kola nut farming, trading, and industrial utilization. Kola nut has served for hundreds of years, as an important article of internal trade in Nigeria and other parts of Africa (Nzekwu, 1961). It has been an item of trade in West Africa and in the trans-Saharan trade routes for many centuries (Egbe and Sobamiwa, 1989). Nigeria accounts for about 70 percent of the total world production of kola nuts (Jacob, 1973).

Kola nut is used as a masticatory stimulant by Africans and has numerous uses in social, religious and ceremonial functions by the natives in the forest region of Africa (Asogwa et al., 2006). It is used during ceremonies such as to marriage, child naming, installation of Chiefs, funeral and sacrifices made to the various gods of African mythology (Opeke, 2005). There is also increasing demand for its usage in pharmaceutical industries and for production of soft drinks, wines, and candles (Beattie, 1970). Its uses have inevitably created a high demand in excess of its production (Oladokun, 1985). While the demand is rising, Nigerian kolanut sector production remains low because many of the trees in Nigeria are unfruitful or have very low yield due to self-and-cross incompatibility among trees, partial and total sterility, inefficient natural pollination, field and storage pests, diseases and old age (both trees and farmers) (Daramola, 1978).

Generally, agricultural production in Nigeria involves using physical strength, which declines with age. This has being observed as one of the major constraints to agricultural production in Nigeria (Okeowo et al., 1999). Youth constitute an important segment of the society and if given necessary support, their contributions cannot be undermined. Youth can be defined as a stage in life cycle before adult life begins. Onuekwusi and Effiong (2002) defines youth as the period, in an individual life, which runs between the end of childhood and entry into the world of work. Okwoche et al 2012 posited that one of the major setback of agriculture development in Nigeria is attributed to inability of the Federal Government to integrate youth into the mainstream of the numerous programmes implemented over the years. NBS, (2005) opined that ageing farming population in Nigeria, with an average age of 47years and life expectancy at 47-50 years in 2008. While youth policy define youth as all young persons, of the age 18-35 years; and for the purpose of this study, the definition will be adopted. Nigeria economy depends on the young people more especially the rural youth, hence constraints militating against their participation in agricultural production deserve to be investigated. On this basis, the study will investigate the constraints hindering youth participation in kola production in OkukuOsun state.

Justification

Youth contribution to agricultural development is significant to national development. Nations that refuse to engage the youth in development despite their unassuming ability to

transform situation if given the enabling environment, will continually dwell in abject poverty. Ugwoke et al (2005) disclosed that, youth have been noted to play a vital role in agricultural production, especially in developing countries. Youth in developing nations of the world including Nigeria, are facing many constrains, which militate against their active involvement in agricultural development. Chikezie et al., (2012) suggested that, with the fewer youth into agriculture, the long-term future of the agricultural sector is in question. There is need to ascertain the contribution of the youth towards kola nut production and their constraints. The result of this study will enable scientists and government to focus on the needs of the kola nut youth farmers in order to strengthen the area of weakness foe increase production,

Objectives

Broad objective

The broad objective is to investigate participatory diagnostic survey of youth involvement in kola nut production in Osun state Nigeria.

Specific objectives are to:

1. Describe the socio-economic characteristics of youth farmers.
2. Ascertain sources of information of youth farmers.
3. Determine the attitude of the youth farmers towards kola nut farming.
4. Identify constraints militating against youth involvement in kola production

Material and Methods

The study was carried out in Osun; Purposive and multi stage random sampling were used to select 60 youth farmers. A well-structured questionnaire and focus group discussion (FDG) were used to elicit detailed information from youth farmers in the study areas.

Stage 1; Osun states was purposively selected for the project

Stage 2: The kola producing community was purposively selected in Osun (Okuku). 60 kolanutyouth farmers was randomly selected.

Stage 3: The data was analysed with frequency and percentages for the descriptive statistics while chi-square will be used for the inferential statistical analysis

Result and Discussion

Among the most important socio - economic variables considered is the respondent's age, sex marital status, farm size and educational level.

The mean age of the respondents in the study areas was 32.32 ±3, this indicates that a higher proportion of sampled kola nut farmers were in their active and productive years. Majority, 95% were male farmers, this could be linked with the tedious nature of kola farming and land tenure system which is patriarchal. Muhammad-Lawal, (2008) opined that sex of an individual can influence the type and quality of work carried out. Majority (71.67%) of the respondents were married this showed that they have more hands on farm work. The results of respondents' educational status reveal that majority (65.83%) of the respondents had both primary and secondary school, the moderately high literacy level could be traced to the age categories of the respondents. Furthermore, 80.83% of the respondents were small scale farmers and (69.10%) were Yoruba tribe. Based on the findings more than half of the population of the respondents inherited the land, this implies that most of the kola nut farms are old.

Table 1. Frequency distribution showing socio-economic characteristics of the respondents

Variable	Frequency	Percentage	Mean	Std. Dev

Age				
21-25	10	16.67	32.32	3.04
26-30	19	32.50		
31-40	31	50.83		
Sex				
Male	57	95.00		
Female	19	30.83		
Educational level				
None	18	29.17		
Primary	18	29.16		
Secondary	22	36.67		
Tertiary	3	5.00		
Ethnic group				
Yoruba	42	69.17		
Ibo	5	8.33		
Hausa	2	4.16		
Others	11	18.33		
Marital status				
Single	17	28.33		
Married	43	71.67		
Farm size (Hectare)				
1 – 5	49	80.83	2.26	1.47
5 – 10	12	19.17		
Land ownership				
Inherited	36	59.17		
Purchased	7	10.83		
Rent	9	14.17		
Cooperative	20	15.83		

Source: Field study 2022

Table 2 revealed that, more than half of the respondents had their sources of information from the village leaders 59.17% while Village extension agents and radio accounted for 45 percent and 50.83 percent respectively. The use of radio as information source is in the study area for as information source is in line with the study of Nwachuckwu (2003) and Obuh (2007). Farmers group accounted for 48.33 %. Cocoa Research Institute of Nigeria accounted for 50.83% respondents as source of information. Respondents (28.33%) used newspaper as their information source. This revealed that, wide range of information sources is identified by the kola nut farmers but village leaders was widely used as source of information. The findings is in line with the study of Nabinta, (2003), who declared that interpersonal communication is the most frequent medium of dissemination of agricultural information.

Table 2: Respondents' Information Sources

Information Sources	Frequency	Percentage
Village leaders	36	59.17
Extension Agents	27	45.00
Radio	31	50.83
CRIN	31	50.83
Newspapers	14	22,50

Farmers group	29	48.33

Source: Field study 2022

The attitudinal scores of kola nut youth farmers in the study area, majority 61.67% have medium attitude. Only 9.17% have high attitude. This (medium attitude) may be due to the constraints being faced in kola nut production, this may contribute to their inability to have high attitude. This implies that youth farmers in the study area need to be encouraged in order to have high attitude.

Table 3: Attitude of youth farmers towards kola nut farming

Variables	Score	Frequency	Percentage
High	≥21.52	6	9.17
Medium	≤21.52≥15.44	36	61.67
Low	≤15.44	18	30.83

Field Study 2022

Table 4 described the respondents' identified constraints militating against their involvement in kola nut production in the study area. Inadequate basic amenities was ranked first, with weighted mean score of 2.85 and (97.50%) of the respondent. The next challenge faced by farmers was rigorous nature of kola nut 2.74 (90.0%). Youth interest and preference in riding commercial motorcycle popularly known as "okada" ranked 3rd as constraint in kola nut production, with weighted mean score of 2.71 (87.5%), likewise, more than half 2.44 (85.0%) respondent attested that low price of kola nut is also a constraint. Others include youth-urban migration, 2.18 (84.17%) while more than half of the population 2.10 (76.67%), indicated that they are being faced with inadequate access to land access. Chemical adulteration was ranked 7th among the constraints 1.78 (57.60%) The findings was supported by Adekunle, et.al, (2009) that there are economic, social and environmental factors reducing rural youth involvement in agricultural production in Nigeria.

Table 4. Distribution of respondents on identified constraints

Services	Very severe	severe	Not severe	Score	WMS	Rank
No basic amenities	57(97.50)	-	(3.330)	413	2.85	1st
Rigorous farming	54(90.00)	-	6(10.00)	393	2.74	2nd
Commercial motorcycle	53(87.50)	-	8(12.50)	387	2.71	3rd
Low price of kola nut	51(85.00)	6(9.20)	4(5.83)	339	2.44	4th
Youth migration	51(84.17)	5(8.30)	5(7.50)	293	2.18	5th
Inadequate land access	46(76.67)	21(17.50)	4(5.80)	220	2.10	6th
Chemical adulteration	35(57.60)	13(21.67)	13(20.83)	193	1.78	7th

Field s Study 2022

Conclusion

The youth farmers in the study area were small scale farmers, majority were males and of moderately high literacy level. Results from the study also revealed that their source of information on kola nut production was village leaders. They have medium level of attitude

towards kola nut farming due to lack of basic amenities as a major constraint debarring them also majority of youth farmers identified preference in commercial motorcycle to farming in the study areas. It is recommended that more village extension agent should be recruited, trained and given appropriate package of good agricultural practices that will address youth farmers' needs in kola nut farming. Government should encourage youth farmers by providing basic amenities, opportunities and incentives to motivate and entice youth into kola nut production in order to increase yield and returns to revamp the sector. In addition, youth kolanut farmers in the study area showed interest in the distributorship of CRIN kola products especially kolawine, they were advised to come for training in the institute in order to take up the technologies also youth farmers asked questions on kola hybrid and they were assured that research is on-going.

References

1. Adekunle, O.A., Oladipo, I.I, Adisa, F.O and Fatoye, A.D. (2009). Constraints to youth's involvement in agricultural production in Kwara State.Nigeria Journal of Agricultural Extension 13(1:102-108).
2. Asogwa, E.U., Anikwe, C and Mokwunye. F.C. (2006)."Kola production and utilization for economic development," African Scientist, vol. 7, no. 4, pp. 217–222.
3. Chikezie, N.P., Chikezie, J., Osuagwu, C.O., Ihenacho, R.A., Ejiogu-Okereke N., Oguegbuchulam, M.N and Obi, K.U. (2012). Factors constraining rural youth's involvement in cassava production in Onu-Imo Local Government Area of Imo State. Nigeria. Global Advanced Research Journal of Agricultural Science 1(8):223-232.
4. Daramola, A.M. (1978). Insect Pests of Cola in Nigeria (Research bulletin), vol. 3, CRIN, Ibadan, Nigeria.
5. Daramola, A.M. (1981) "The biology of the kola weevils Balanogastriskolae on Cola acuminata and C. Verticilata," Insect Science and Its Application, vol. 2, no. 4, pp. 201–205.
6. Egbe, V and Sobamiwa,O. (1989). "Utilization of cocoa, kola, coffee, cashew and tea in Nigeria," in Progress in Tree Crop Research, pp. 217–224, CRIN, Ibadan, Nigeria, 1989.
7. Jacob, V. J. (1973). Yield characteristics, incompatibility and sterility studies in Cola nitida (Vent) Schott &Endlicher [Ph.D. thesis], University of Ibadan.
8. Muhammad-Lawal, A., Omotesho, O.A and Falola, A. (2009). Technical efficiency of youth participation in agriculture: A case of the youth-in-agriculture programme in Ondo State, South-West Nigeria. Nigerian Journal of Agriculture, Food and Environment. 5(1):20-26.
9. Nabinta, R.T. (2003). Analysis of the role of Female Farmers in Household Energy Management in Kaltungo Local Area of Gombe State.
10. National Bureau of Statistics, NBS (2008). Publications 2008 and 2009.
11. Nwachuckwu I, (2003). Agricultural Communication: Principles and Practice. Lamb House Publishers, Umuahia. 120pp.
12. Nzekwu, O. (1961) "Kola nut," Nigeria Magazine, vol. 71, pp. 298–305.
13. Obuh, J. (2007). Effectiveness of Communication Strategies of extension agents Global Approaches to extension practices. (GAEP), vol.3 (2).Pp 152- 155.
14. Okeowo, T.A., Agunbiade, J.B and Odeyemi, L.A. (1999). An assessment of level of involvement of farm-children in farming decision in Ikorodu area of Lagos State. In: Farm Children and Agricultural Productivity in the 21st century, proceedings of the Second Pp. 275-282.

15. Okwoche, V.A., Ade, A.I and Alegwu, F.O. (2012). An assessment of youth participation in agriculture and rural development. Benue State, Nigeria Agricultural Journal 7(5):365-369.
16. Oladokun, M. A. O. (1985). "Objectives and achievements in Kola propagation. Research paper presented at a symposium to mark the 21st Anniversary of the Establishment of CRIN".
17. Oladokun, M. A. O. (1985). "Objectives and achievements in Kola propagation. Research paper presented at a symposium to mark the 21st Anniversary of the Establishment of CRIN," 1985.
18. Onuekwusi, G.C and Effiong, E.O. (2002). Youth empowerment in rural areas through participation in rabbit production.A case of Akwa-Ibom State. Nigeria. Nigerian Journal of Rural Sociology. 4:95-99.
19. Opeke, L. K. (2005). Tropical Commodity Tree Crops, Spectrum Books Limited, Ibadan, Nigeria.
20. Quarcoo, T. (1973). A Handbook on Kola, CRIN, Ibadan, Nigeria.
21. Ugwoke, F.O., Adesope, O and Ibe, F.C. (2005). Youth participation in farming activities in rural areas of Imo State, Nigeria: Implications for extension. Journal of Agricultural Extension 8:136-142.
22. Van Eijatten, C. L. M. (1969). Kola, Its Botany and Cultivation, vol. 59 of Communication, Royal Tropical Institute, Amsterdam.The Netherlands.

2021 ANNUAL REPORT

Gender Differentials in the Processing of Kolanuts for Marketing in the Southwest Nigeria

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Introduction

Kola grows as a tree form and it is believed that kola trees are native to Ghana and Ivory Coast and their spread has brought about by humans (American Horticultural Society, 2002). There are over fifty species of kola. Of these, seven have edible nuts, but only two have been widely exploited, these are *cola nitida*and *cola acuminata.* These species have been important objects of trade for a long time. The most important is *cola nitida*because of its wide economic value (Oluyole *et al*, 2009). Kola is mostly produced in Africa and is cultivated to a large degree in Nigeria but also in Ghana, Ivory Coast, Brazil and the West Indian Islands (Oludemokun, 1983; Opeke, 1982). Annual production from these countries alone is in excess of 250,000 tons while the world production is about 300,000 tons (American Horticultural Society, 2002). According to Quarcoo (1969), Nigeria produces 88% of the world's kola production and 90% of this is consumed locally while the remaining 10% is exported. This finding was buttressed by Oluokun and Oladokun (1999) who claimed that Nigeria produces two million metric tons of kolanut annually which represented 70% of the world's kolanut

production. Kolanut post-harvest processing starts by careful examination and sorting out pods infested with weevils, diseases and other deformities, from the healthy pods. The seed coat or testa of the nuts from these healthy pods are removed by soaking the nuts in clean water for 24 h to enhance rottening, after which the nuts are skinned and rinsed in fresh water. The rinsed nuts are collected in wide flat baskets through which excess water drains off before they are kept inside the room where they are maintained under ambient room temperature for a period of three days to cure. Defective/infested nuts are picked out during this curing process that usually involves considerable sweating to reduce the moisture content of the nuts. The nuts are then graded into sizes for proper preservation in big sized baskets (Asogua*et al,2011).*

Kola is an important economic cash crop to a significant proportion of Nigerian population who are involved in kola farming, trading and industrial utilization. However, Nigeria accounts for about 70% of the total world production of kolanuts (Oluokun and Oladokun, 1999; Oluyole, *et al*, 2009). The kolanut is used as a masticatory and stimulant in the tropics. It also has industrial usage in pharmaceuticals, production of soft drinks, wines and in confectionaries (Oguntuga, 1975). The kolanut pod husk, which is a byproduct from processing the nut, is widely used for animal feeding because of its high nutritive quality. According to Babatunde and Hamzat (2005), broilers fed with kolanut pod husk meal diets had an outstanding growth performance. Apart from this, kolanut is a very important farm produce which is used in extensive culturally and consumption. Culturally, kolanut is used to observe naming ceremony, wedding ceremony and for entertaining visitors. However, extensively, kolanut is consumed in Nigeria, especially in the Northern part of Nigeria. It is on record that the substantial proportion of the kolanut being produced in Nigeria is consumed domestically (Oluyole *et al*, 2009).

However, the shelf life and quality of this valuable farm produce is improved byprocessing. The processing activities are undertaken by both the male and female. Therefore, the main aim of this project is to determine the gender differentials in the postharvest processing of kolanut.

Methodology

The study was carried out in Ondo State of Nigeria. Two kolanut producing Local Government Areas (LGAs) were purposively selected from the State. Hence, Ife East and Ondo East were selected. From Ife East, Ifekola was selected while Bolorunduro community was selected in Ondo East. A total of 150 kolanut processors were randomly selected from the two communities. A structured questionnaire was used to collect information from the respondents. The data retrieved from the information collected were analysed using descriptive statistics.

Results and Discussion

Table 1 shows the demographic/socio-economic characteristics of the respondents (kolanut processors). The table shows that most (70.67%) of the respondents are 50 years and below while 29.33% of the respondents are above 50 years of age. This indicates that most of the kolanut processors are still active to participate in the business. This is a good indicator as this would

improve the efficiency of the processors. Table 1 also shows that all (64.67%) of the marketers are females showing that female participate more in the business. This result is in consonance with Adamu*et al* (2006), who stated that majority of rural women engaged in off-farm activities such as packing of farm produce, processing of farm produce, storage of crops among others while their male counterparts are involved in the production of tree crops. It could also be revealed from Table 1 that most (89.33%) of the processors are married while some (4.00%) are widow. This is an indication that there would be more availability of family labour that would assist in the run of the business. Table 1 also shows that 83.33% of the respondents are having formal education. It could be observed that majority of the processors are having formal education. This is likely to have a positive impact on the profit level of the business as education increases the efficiency. Education enables one to be able to read and interpret a new technology thus will enable him to be able to apply such a technology appropriately and hence increases his efficiency. Most (58.0%) of the respondents are well experienced in kola processing as they have been doing the work for more than 10 years. This is a good indicator as long years of kola processing experience tend to increase the efficiency of the processors. Table 1 also shows that majority of the processors (94.67%) deal with kola nitida. This shows that Kola nitida is more predominant in the study area.

Table 1. Socioeconomic Characteristics of the Respondents

Variables	Frequency	Percentage
Sex		
Male	53	35.33
Female	97	64.67
Total	150	100.00
Age (Years)		
≤ 20	6	4.00
21-30	40	26.67
31-40	32	21.33
41-50	28	18.67
51-60	26	17.33
> 60	18	12.00
Total	150	100.00

Marital Status		
Married	134	89.33
Single	8	5.33
Divorced	2	1.34
Widowed	6	4.00
Total	150	100.00
Educational Levels		
No formal education	25	16.67
Primary education	58	38.67
Secondary education	51	34.00
Tertiary education	16	10.66
Total	150	100.00
Household size		
≤ 6	70	46.67
7-10	74	49.33
>10	6	4.00
Total	150	100.00
Years of experience (years)		
≤ 10	63	42.00
11-20	42	28.00
21-30	21	14.00
31-40	9	6.00
41-50	6	4.00
Total	150	100.00
Variety of kolanut dealing with		
Kola nitida	142	94.67
Kola acumulata	8	5.33

Total	150	100.00

Source: Field survey, 2022

Table 2 shows the gender that actually carries out a particular activity in kolanut processing. The table shows that all the activities are being carried out by more women than men. Hence, it can be said that kolanut processing is more of feminine job. Notwithstanding, few male still participate in all the activities under kolanut processing.

Table 2. Gender participation in kolanut processing

Activities	Adult male		Adult female	
	Freq	%	Freq	%
Soaking of kolanuts in preparation for peeling	15	10.00	137	91.33
Peeling of kolanuts	6	4.00	146	97.33
Washing of the peeled kolanuts	4	2.67	145	96.67
Preservation of the peeled kolanut	21	14.00	129	86.00
Parkaging of the peeled kolanuts	15	10.00	135	90.00
Transportation of the peeled kolanuts to the market	15	10	134	89.33

Source: Field survey, 2022

Table 3 shows the problems encountered in the course of kolanut processing by the processors. The table shows that 46.00% of the processors agreed that fresh kolanut is always very difficult to get while 5.002% of the processors believed that it is not difficult to get fresh kolanut to buy. In a similar manner, 52,67% of the respondents agreed that preservative chemicals are not always available to buy while 45.33% did not agree. As regards the labour availability for peeling, 45.33% of the respondents are of the opinion that labour for peeling are always very difficult to get while 53.33% did not believe it. To some of the processors (32.67%), leaves for storing kolanut is always very difficult to get while most of the processors (63.33%) believed that one can get the leaves with ease. As regards the preservative chemicals, 52.67% of the processors believed that the chemicals are not always available and 52.00% believed that even if the chemicals are available, they are always very expensive to buy.

Table 3. Problems encountered in kolanut processing

Problems	Yes		No	
	Freq.	%	Freq.	%
Fresh kolanut is always very difficult to get buy	69	46.00	78	52.00
Labour is always very difficult to get for peeling	68	45.33	80	53.33
The leaves for storage is always very difficult to get	49	32.67	95	63.33
Preservative chemicals are not always available to buy	79	52.67	68	45.33
Preservative chemicals are always expensive	78	52.00	70	46.67
Problems of kolanut spoilage is very common during preservation	88	58.67	60	40.00

Source: Field survey, 2022

Conclusion

The study which was carried out on gender differentials in the processing of kolanuts reveals that more women are involved in all the activities involving kolanut processing than men. The study also revealed that most of the processors in the study area deal with Kola nitida showing that this is the variety of kolanut that is common in their area. Some of the problems confronting kolanut processing according to some processors in the study area include unavailability of kolanut to buy, difficulty in getting labour for peeling, difficulty in getting leaves for storing kolanuts, inavailability and expensiveness of the preservative chemicals. However, to some processors, they are not being faced by the mentioned problems.

References

American Horticultural Society.(2002). The American Horticultural Society Encyclopedia of flowers.D.K. publishing, New York.

Asogwa, E.U., Otuonye A.H., Mokwunye F.C., Oluyole K.A., Ndubuaku, T.C.N. and Uwagboe, E.O (2011).Kolanut Production, Processing and Marketing in the South-eastern States of Nigeria. *African Journal of Plant Science.*Vol. 5(10), pp. 547-55.

Babatunde, B.B. and Hamzat, R.A. (2005). Effects of feeding graded levels of kolanut husk meal on the performance of cockerels. Nigerian Journal of Animal Production. Vol. 32, No. 1 Pp. 61 – 66.

Oguntuga, D.B.A. (1975). Chemical composition and potential commercial uses of kola nuts, *Cola nitida*(vent) schoot and Endlicher. Ghana J. Agric Sci., 8: 121-125.

Oludemokun, A.A. (1983). Processing, storage and utilization of kola nuts, *cola nitida*and *cola acumunata.*Tropical science, volume 24, Pp. 111 – 117.

Oluokun, J.A. and Olalokun, E.A. (1999). The Effects of graded levels of brewers spent grains and kola nut pod meal in the performance characteristics and carcass quality of rabbits. Nigerian Journal of Animal Production.Vol 26, Pp. 71 – 77.

Oluyole, K.A., Adebiyi, S. and O.O. Fagbami. (2009). Economic Analysis of Kolanut Production in Osun State, Nigeria.International Journal of Sustainable Crop Production. Vol. 4, Issue 3, Pp. 12-15.

Opeke, L.K. (1982). Tropical Tree Crops, John Wiley, Chi Chester.

Quarcoo, T. (1969).Development of kola and its future in Nigeria.Reprinted from proceedings of Agricultural Society of Nigeria.

2021 Research Report

Title: Genetic characterization of Nigeria Kola Germplasm

Investigators: Sobowale, I. O, Adenuga, O.O, Orisajo S. B, Adebiyi, S.

Introduction: Kola nut is an important commercial crop cultivated mostly in Africa (Dadzie et al., 2013). The seed of *C. nitida* fruit (pod) is referred to as kola nut and morphologically, it has three distinct colours including white, red and pink. Kola nuts are rich in essential chemical compounds including water, fat, ash, fibre, carbohydrates and proteins. Kola nuts are known for their high caffeine content, between 1.84 and 2.56% (Nyamien et al., 2014). Additionally, secondary metabolites, such as polyphenols, alkaloids, saponins and terpenoids, abound in kola nuts and they are produced when the plant is under stress (Pagare et al., 2015). In some West African countries including Ghana and Nigeria, the nuts are chewed mostly to suppress sleep and hunger (Adedayo et al., 2019; Olaniyan et al., 2018). Moreover, it has several traditional, social and medicinal importance, such as treatment of asthma and

whooping cough (Adedayo et al., 2019; Dorathy et al., 2014). In addition, the cola nut plays an important role in African society for cultural and customary rituals such as births and weddings (Durand et al., 2015).To improve the Nigerian kola, Cocoa Research Institute of Nigeria (CRIN) has embarked on a number of projects including the collection of kola accessions from different farmer's field in Nigeria, although with no distinguishing features. These are maintained as field gene banks with the view to effectively incorporate them in breeding programmes. Molecular characterization, which highlights the amount of genetic diversity and relationship among various groups of different accessions, is required for a direct and more reliable selection in kola genotypes.

Objectives: To assess and characterize Nigeria kola germplasm from CRIN collections using molecular methods for further breeding improvement.

Materials and Methods

Fresh young leaves samples of each of the selected twenty accessions of kola material were harvested at in well labeled and tightly covered sample bags. The samples were placed on ice pack and immediately convey to biotechnology laboratory for DNA extraction and genetic profiling usingInter Simple Sequence Repeat Marker (ISSR) procedure.

Results and Discussion

Extracted DNA obtained across the twentykola accessions showed sharp and clear bands. DNA bands did not indicate smearing (degraded DNA) as seen from the agarose gel electrophoresis picture and the genomic DNA was a satisfactory PCR template (Plate1). Figure 1 is a dendrogram showing genetic similarity among the 20accessions of kolaas revealed based on ISSR markers. At similarity level of 0.70, all the accessions formed a single cluster. The dendrogram also showed that the first linkage was formed between IBDLS04 and IBD01 at 1.00 similarity level. At 0.83 similarity level, the dendrogram revealed five distinct groupings. Group II and V had one accession each, group I had 2 accessions, group IV had 3accessions and group IIIhad 13 accessions, the highest number of accessions (Figure 1).The grouping of the ISSR dendrogram has demonstrated polymorphic nature and wide genetic base of 20 kola accessions investigated.

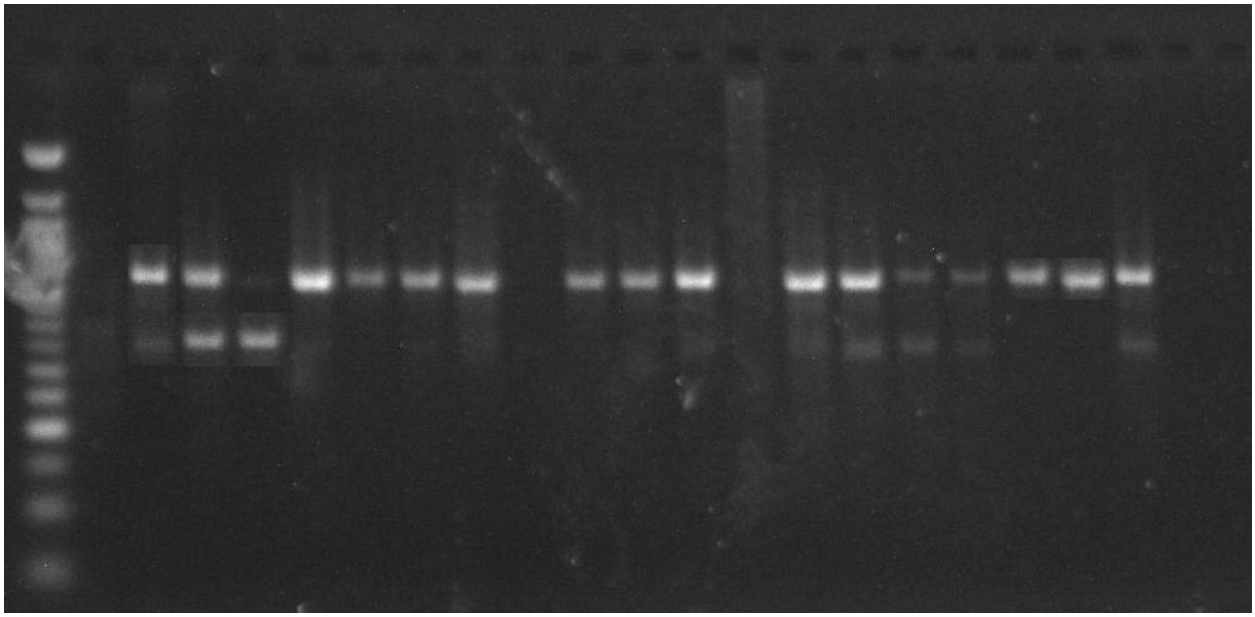


Plate 1: DNA of 20 accessions of kola visualized on Agarose gel electrophoresis

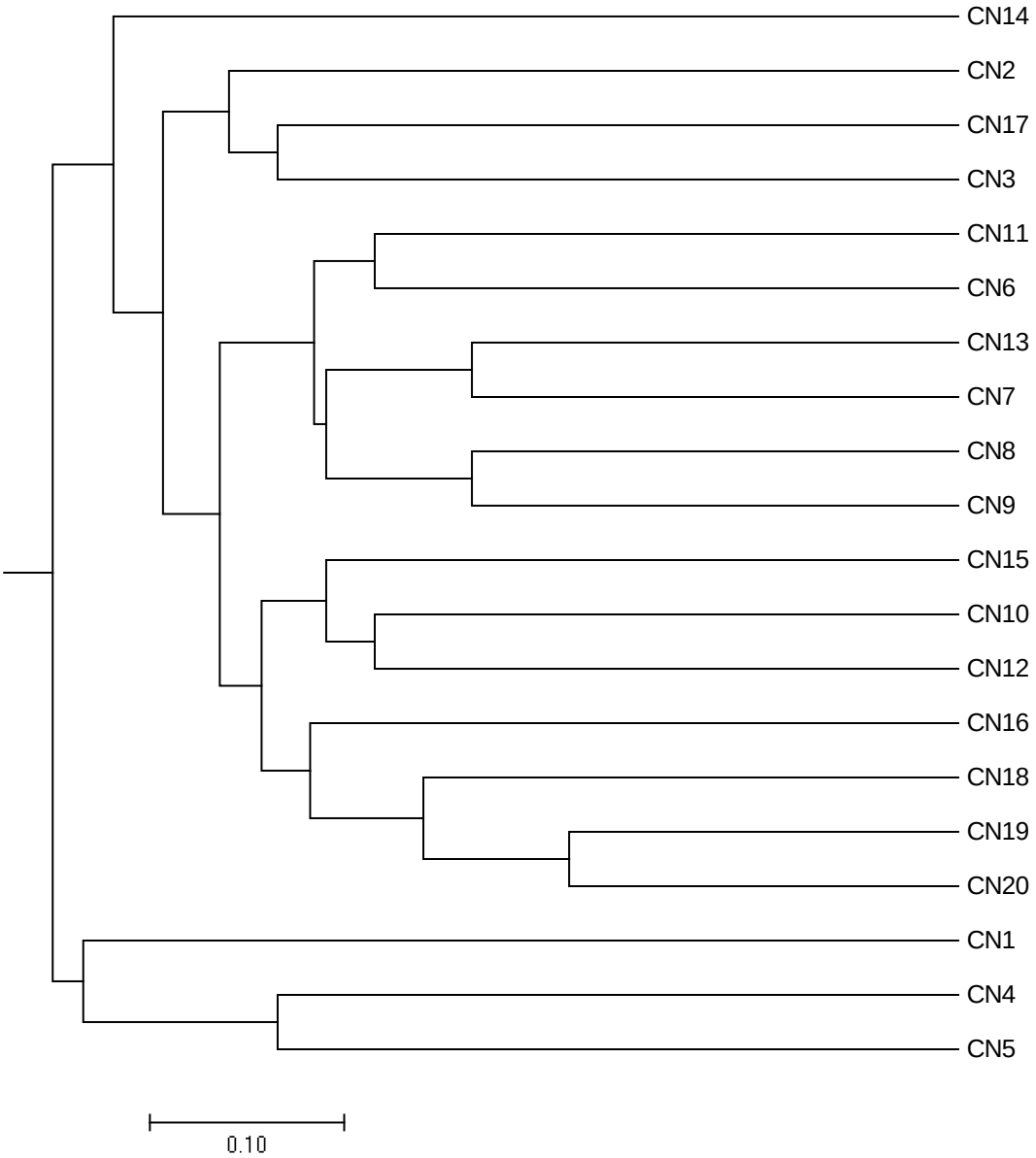


Figure 1: Molecular Dendrogram showing genetic similarity among the twenty accessions of kola based on ISSR markers

Conclusion and Recommendation

The results of this study indicated that ISSR analyses provide an effective tool for the analyses of genetic diversity in *Cola* species. The ISSR method developed need to be adopted and optimized in order to establish a sound database of genetic diversity in *Cola*.

References

Adedayo, L. D., Ojo, A. O., Awobajo, F. O., Adeboye, B. A., Adebisi, J. A., Bankole, T. J., Ayilara, G. O., Bamidele, O., Aitokhuehi, N. G., & Onasanwo, S. A. (2019). Methanol extract of cola nitida ameliorates infiammation and nociception in experimental animals. *Neurobiology of Pain*, *5*, 100027. https://doi. org/10.1016/j.ynpai.2019.100027

Dadzie, M. A., Opoku, S. Y., Akpertey, A., Akrofi, A., Lowor, S., Assuah, M. K., & Amoah, F. M. 2013. Kola cultivation in Ghana. *Technical bulletin no* (Vol. 26 1,4).Cocoa Research Institute of Ghana.

Dorathy, I. U., Okere, S. O., Daniel, E. E., & Mubarak, L. L. (2014). Phytochemical Constituents and antidiabetic property of *cola nitida* seeds on alloxan-induced diabetes mellitus in rats. *British Journal of Pharmaceutical Research International*, *4*(23), 2631–2641. https://doi. org/10.9734/BJPR/2014/13071

Durand ND, Adoukonou-Sagbadja H, Nafan D, Adjanohoun A, Baba-Moussa F, Sina H, Sezan A and Baba-Moussa L. (2015). Indigenous knowledge and socioeconomic values of three kola species (*Cola nitida, Cola acuminata and Garcinia kola*) used in southern Benin. *European Scientific Journal, 11(36), 206–227.*

Olaniyan, A. B., Kolapo, K. A., & Hammed, L. A. (2018). Physico-chemical characterisation of kola nuts [*cola nitida*, vent. (schott & endl.) as influenced by curing period. *Tropical Agriculture (Trinidad)*, *95*(2), 125–131

Pagare, S., Bhatia, M., Tripathi, N., Pagare, S., & Bansal, Y. K. (2015). Secondary metabolites of plants and their role: Overview. *Current Trends in Biotechnology and Pharmacy*, *9*(3), 293–304.

Nyamien Y, Adje F, Niamke F, Chatigre O, Adima A and Biego H. (2014). Caffeine and phenolic compounds in *Cola nitida* (vent) Schott and Endl and *Garcinia kola* Heckel grown in Côte d'Ivoire. *British J. Applied Sci. Technol, 4(35), 4846–4859.*

ANNUAL REPORT 2021
KOLA RESEARCH PROGRAMME

Determination of Kolanuts production volume in Nigeria (Adebiyi S, Adenuga, O.O Yahaya A.T. Oduwole O.O Ibiremo, O.S and Ogunlade M.O)

Introduction

Kola is a family of starculiceae and was first introduced in Nigeria in 1556 by a man called Johnannas Leo Africanus. The occurrence was traced to Congo in 1591 by a Portuguese called OdoradoLapez. It is believed that Kola trees are native to West African countries these are Ghana, Nigeria, Republic of Benin Ivory coast (Cote D'ivoire) and their spread has brought about by humans (American Horticultural Society, 2002).

There are over Fifty species of Kola of these, seven are edible nuts while only two have been widely exploited these are cola nitida and cola acuminata. Out of these two species, cola nitida is being traded internationally, while the consumption of cola acuminata is confined to Southern Nigeria (Opeke 2007) Kolanuts which is widely consumed by virtually all category

of people is found useful in the production of beverage, flavouring materials, alkaloids, caffeine, theobromine laxatives, heart stimulants and sedatives (Hamzat and Olubamiwa 2003).
These potentials attracted many people to consume Kolanuts, most especially people from Northern Nigeria consumes cola nitida, while people in Western Nigeria uses cola acuminata in consulting gods and worship by the Easterner as the case may be (Adebiyi et al 2009).
The two important varieties are of economic, social and scientific importance. However, the actual production figure of this commodity became an issue in social research as the actual figure cannot be ascertained. Though, National bureau of statistic in its National survey of Exportable Agricultural commodities recorded 174,230,000 metric tons asKolanuts production volume. Nevertheless, due to the chains of supply and demand in kolanut industry, it is always difficult to measure what farmers produce from their farms or collates what was produced from community to community.
Nevertheless, the activities of middle men in all the trading stages bring complication in the determinants of the actual kolanuts produced at a particular production period.
In the survey conducted by National bureau statistic, the total production figure of Kolanuts is 174,230,000 tons out of which the five states in the Westerns Nigeria including Lagos produces 158,067,000 tons while the remaining 13 states contributed just about 15,006,000 tons of the total volume produced in the country National bureau of statistic (2012). In the same vein, Quarco (1969) revealed that Nigeria produces 88% of the world's Kola production and 90% of this is consumed locally while; the remaining 10% is exported. Akinbode (1982) revealed that Kolanuts are produced mainly in the Southern part of Nigeria and largely marketed and consumed in the Northern part. Many villages in Yoruba land are occupied by Hausa trader of which Kolanut is the main commodity crop. These Hausa traders engaged in buying Kolanuts from Kolanut wholesalers, Packing and sending them to the Northern Nigeria (Tachie – Obeng and Brown 2006).
The Yoruba communities in the Southern Nigeria equally engaged in kolanuts trading thereby organized themselves into groups and create a platform of kolanut movement from Yoruba communities to different states and communities in Northern Nigeria.

Objectives of the study

1. Identity groups and organization available in the study area.
2. Ascertain different community and collation centers used for kolanut movement.
3. Determine volume of kolanuts moved in all identified communities.
4. Determine kolanutouput in Nigeria.

Methodology

Multistage sampling procedure was used to select kolanut movement centers.
The first stage was purposive selection of five (5) states known for movement of kolanuts to Northern Nigeria and other neighbouring West African countries.
The second stage involved purposive selection of communities where kolanuts are packed and moved to different places in Northern Nigeria and other countries.
The third stage involved purposive selection of communities and centers where kolanuts are collated and moved to the areas where they are needed.
Kolanut marketers were identified with the help of kolanut groups available in the study area. Record booklets were given to all stakeholders of each center who takes record of all kolanuts moved out of their centers. Record booklets were left with one literate individual to complete and collated in all identified communities and centers. Data obtained from the record of movement of kolanuts was analysed using descriptive statistics.

Result and Discussions

Table 1 revealed that Osun state (62.3%) is the highest in terms of community involved in kolanut movement. This was followed by Ondo state (14.8%) and Ekiti state (12.7%). The finding revealed that, there were more collation communities and centres in Osun State. The reason could be that Osun state is the third lagest producer of kolanuts and shared boundary with all major producing states these are Ogun, Ondo, Oyo and Ekiti states (National bureau of statistics 2012). The smallest in terms of collation center which is Lagos state (0.89%) could be of a result of urbanization which has reduced Kolanuthectrage in the state.
Table: 2 revealed that 61.8% of the ownership of collation centers was female from Osun state while 37.8 were male from Osun state. The finding revealed that 24.4% and 10.5% of the respondents were female marketers from Ondo and Ekiti states respectively. Also, male respondents out-number female respondent in Ogun (24.0%) and Lagos state (2.1%).
Table: 3 revealed that 52.6% of the respondents belonged to kolanut producers and marketers association of Nigeria, While, 37.6% belonged to OmoOduakolanuts growers and sellers association of Nigeria. Nevertheless, few members (9.8%) were not in any group or association. Majority (90.2%) of the sampled participants belonged to group association. This is an indication that kola marketers have opportunities for skill acquisition, social and economic opportunities as a group with more responsibilities and enlightens to improve in their trading methods. Social group serves as morale booster, linkage to source of credit and medium of information dissemination. This was supported by (Adeleke- Bello and Ashinmolowo 2015) that group membership helps member to become better informed about the world and change the situation around them.
Table 4 revealed communities where kolanuts were collated from Osun state to Northern Nigeria and some neighbouring countries. Data collated from booklet revealed that; the total of 70,090 tons was recorded; Garage Olode (15.3%), Owena-Ijesha (15.2%) and Ifon-Osun (14.8) recorded more tons than any other communities in the state. These may be as a result of large population of Hausa tribe who always traded on kolanuts as a commodity crop.

Table 5 revealed communities in Ekiti State. The total of 6,382 tons was recorded of which AjegunleIseEkiti (21.820) and IjanEkiti (18.0%) had highest production figure.

Table 6 revealed few communities noted for movement of kolanuts in Ogun state, it was revealed that Shagamu (97.7%) was the major center for movement of kolanut. Other communities such of Owode –Egba ((0.8%) Owode – Idi Iroko (0.70) and Ogunmakin (0.5%) recorded very small volume.

Table 7 revealed movement volume in Ondo state. Ore (67.0%) had the highest figure, this was followed by Ondo (21.1%) and Ikare – Akoko (11.98). These three communities were the major centers, in which Ore was the center market for kolanuts coming Edo state which has available land and potential for increased kolanuts production.

Table 8 revealed that Agege (85.5%) a community in Lagos state still retain the history of kolanut in Nigeria. The Hausa traders still sustain their trading activities with kolanuts. Kolanuts from Ghana moved to Agege where it is moved to the Northern Nigeria.

Table 9 revealed the total sum of 189,943 tons of kolanuts was collated from Osun state (70,090 tons), Ekiti state (6,332 tons), Ogun state (24,194 tons), Ondo state (67,927 tons) and Lagos state (21,400 tons).

Conclusion

Collation center creates platform through which data for the study was gathered. Record on the volume of kolanuts leaving various communities was collated in each of the center identified. There were more communities engaged in kolanut movement in Osun state (62.3%) than any other state. Kolanut trading was dominated by female in Osun ,Ondo and Ekiti state while male dominated kolanut trading in Ogun and Lagos State.

Majority (90.2%) belonged to group organization while few (9.8%) were not. The study revealed the total sum of 189,943 tons as volume of kolanuts leaving all identified collation centers, out of which Osun state recorded (36.9%), Ondo state (35.8%), Ogun state (12.7%), Lagos state (11.3%) and Ekiti state (3.3%). The study concluded that, kolanut is an important commodity crop which creates business activities for both male and female in the study area. It is also a commodity crop that is traded between south and northern Nigeria, thereby brings unity and understanding which made them to co-exist.

Recommendation

Kolanuts produced in Southern Nigeria are moved to Northern Nigeria, thus brings unity and mutual understanding between tribes. This is germane in addressing incessant insecurity challenges facing the country. In an approach to sustain production and prevent extinction, government, non-governmental organizations and farmers' organization should come together to address production and marketing problems face kola industry in Nigeria.

Table 1.Distribution according to collation center

State	Frequency	Percentage
Osun	535	62.3
Ondo	127	14.8
Ogun	79	9.2
Ekiti	109	12.7
Lagos	7	0.8
TOTAL	857	100.0

Table 2 Distribution according to Gender of ownership of collation center

State	Male		Female	
	Freq. Percentage		Freq. Percentage	
Osun	109	37.8	426	61.8
Ondo	69	2.4	168	24.4
Ogun	68	24.0	21	3.0
Ekiti	36	12.5	73	10.5
Lagos	6	2.1	01	90.1
TOTAL	288 100.0		689 100.0	

Table 3 Distribution according to group/organization of respondents

Group/ Association	Freq.	Percentage
Kolanut producers& marketers association of Nigeria	451	52.6
OmoOduakolanuts growers &sellers association of	322	37.6

Nigeria		
Non- Membership of group	84	9.8
TOTAL	857	100.0

Table 4.Distribution according to volume collated per community in Osun state

Community	Volume (ton).	Percentage	Community	Volume (ton)	Percentage
Osogbo	980	1.4	Iwo	2,680	3.8
Ifon- Osun	10,340	14.8	Ile-Ogbo	439	0.6
Ipetu-Ijesha	420	0.6	Oluponna	986	1.2
Owena-Ijesha	10,680	15.2	Gbongan	624	0.9
Okuku	375	0.5	Orile-Owu	164	0.2
Irele	165	0.2	Ode-Omu	260	0.4
Garage-Olode	10,700	15.3	Ikeji-Arakeji	152	0.2
Ile- Ife	664	0.9	Ilesha	3,422	4.9
Araromi	227	0.3	Ogbagba	327	0.5
Oore	327	0.5	Ikeji-Ile	115	0.2
Okinni	340	0.5	Ire	608	0.9
Ilobu	6,220	8.9	Ila-Orangun	6,690	9.4
Erin-Osun	480	0.7	Ilare-Ijesha	225	0.3
Iragbiji	767	1.0	Ora	206	0.2
Ikirun	6,690	10	Oyan	231	0.3
Ede	3,222	4.6	Iresi	303	0.4
TOTAL				70,090	100.0

Table 5.Distribution according to volume collated per community in Ekiti state

Community	Volume (ton).	Percentage
Ajegunle- Ise	1380	21.8
Aramako	464	7.3
Ijan	1140	18.0
Kajola	476	7.5
Temidire	349	5.5
Afolu	668	10.5
Ogbese	384	6.1
Odole	454	7.2
Aba-Obasa	336	5.3
Aba-Osogbo	240	3.8
Osan	181	2.9

Otun	260	4.1
TOTAL	6,332	100

Table 6.Distribution according to volume collated per community in Ogun state

Community	Volume (ton).	Percentage
Ogunmakin	120	0.5
Shagamu	23,200	97.7
Owode Idi-Iroko	180	0.7
Owode – Egba	193	0.8
TOTAL	24,194	100

Table 7.Distribution according to volume collated per community in Ondo state

Community	Volume (ton).	Percentage
IkareAkoko	8,080	11.9
Ore	45,532	67.0
Ondo	14,315	21.1
TOTAL	67,927	100

Table 8.Distribution according to volume collated per community in Lagos state

Community	Volume (ton).	Percentage
Agege	18,300	85.5
Imota	3,100	14.5
TOTAL	21,400	100

Table 9.Distribution according to volume collated in the sampled state

State	Volume (ton)	Percentage
Osun	70,090	36.9
Ekiti	6,332	3.3
Ogun	24,194	12.7
Ondo	67,927	35.8
Lagos	21,400	11,3
TOTAL	189,943	100.0

SOME MEMBERS OF KOLANUT PRODUCERS & MARKETERS ASSOCIATION OF NIGERIA
POSED WITH MR ZACHARY, A FOREING INVESTOR IN KOLA INDUSTRY

Truck loaded with 3000 packs of kolanut leaving collation center in Ondo to Northern Nigeria.

A VISIT TO KOLA FARM IN OKUKU, OSUN STATE

2nd from Rt. Mr. Zachary, Mr. Abu (Farmer), Dr. Ibiremo, Mr. Oladele (Farmer) and Dr. Adebiyi

REFERENCES

Akinbode. A (1982) Kolanut production and trade in Nigeria. Nigeria Institute of Social and Economic Research (NISER), Ibadan page 97

American Horticultural Society (2002) The American Horticultural Society Encyclopedia of flower. D.K. Publishing, New York.

Adeleke-Bello, O. O. and Ashimolowo, O. R. (2015): Beneficiaries' perception of selected rural women empowerment project in Ogun State, Nigeria. African Journal of Agricultural Research 10(44): 4108 - 4116.

Quarcoo, T. (1969) Development of kola and its future in Nigeria. Reprinted from proceedings of Agricultural Society of Nigeria.

Opeke. L.K (1987) Tropical Tree Crops

Tachie-Obeng, E and Brown,N (2006) cola nitida and cola acuminate. A state of knowledge report Undertaking for the Central African Regional Programme for the Environment. Oxford

Forestry Institute, Department of Plant Science. University of Oxford, United Kingdom. 37 pp

INTERNAL AUDIT ANNUAL REPORT FOR YEAR 2021

The Internal Audit Division is saddled with the responsibility of monitoring and evaluating the internal control system put in place by the management; and also ascertains the strength of these control measures. We provide complete and continuous audit of the accounts and records of revenue and expenditure, assets, allocated and unallocated stores (FR 1701). Where the need arises, we investigate specially into suspected cases of fraud in the Institute. We are also abreast of the ongoing government financial reforms to the level of access granted. The division is directly responsible to the Executive Director.

DIVISIONAL STAFF STRENGHT

Our staffs are professionally qualified and are very diligent in the discharge of their duties As at 31st of December, 202, the division had thirteen (13) staff. Five (5) of these are in the accountants cadre; Six (6) are in the Executive officers cadre; and two (2) are secretarial officers. One of the executive officer is on study leave.

OUR DUTIES

As part of our responsibilities as stipulated in the Financial Regulation (FR 1701), the division ensures that:-

- Ensure that transactions and event recorded and disclosed actually occurred and pertain to the institute.
- Ensure that transactions and activities that should have been recorded have been appropriately recorded.
- Amount disclosed in the records were appropriately recorded so as to avoid errors or fraud.
- We ensure that transactions and events were recorded to the correct accounting time and period.
- Transactions and events were properly presented.
- Assets and liabilities actually exist in the name of the institute and that the institute has total control of it.

ACHIEVEMENTS

In the year under review, the division has been able to achieve the following feats:

- Ensure compliance with government rules and regulations; and other official gazettes and circulars.

- Cost reduction and controls have improved drastically, as we have been able to manage these by ensuring the best quality of items or material is bought for the institutes use.
- Increase in the level of compliance with the different control measures (preventive, detective, corrective, directive and compensating) put in place.
- The rate of retirement of advances by staff have improved compared with the previous years as the rule of no retirement of previous advances before getting another was strictly enforced.
- Proper monitoring and evaluation of the internal control mechanisms put in place by the management of the Institute.
-
- No extra budgetary spending; expenditures were wholly, reasonably, exclusively and necessarily incurred.
- On a regular basis, physical inspection of the Institutes assets were carried out for update on existence, current value, completeness, rights & obligations and allocation of these assets.

CHALLENGES

Funding is a major challenge facing the division. Audit is continuous and it is evidenced based. Getting sufficient, appropriate, relevant and reliable evidences to back up our opinion on a particular phenomenon require funds. Another challenge of the division is the perspective of staff as to what audit stands for. Many see our job as a witch hunt exercise rather than for the good of the institute; there is need for reorientation.

CONCLUSION

Our role is to add credence and value to the realization of the institutes mandate by ensuring that resources are allocated and used economically, efficiently and effectively. We therefore enjoin you to join in the crusade of value addition so as to take the institute to greater height.

PRODUCTION AND SUBSTATIONS DEPARTMENT

2021 ANNUAL, REPORT

HOD: DR. M.O. OGUNLADE

PLANTATION AND ESTATE MANAGEMENT

The detailed analyses of the activities of the year under review are itemized below:

A. **STAFF STRENGHT / DISPOSITION**

S/N	Unit	Effective Hectare	No. Of Staff	No of PCW
1	PEM	-	4	
2	ZONE 1	34.79	18	
3	ZONE 2	15.14	13	
4	ZONE 3 & 4	15.19	10	
5	ZONE 5	27. 63	16	
6	ZONE 6	26.00	16	10
7	ZONE 7	23.85	11	
8	ZONE 8	41. 05	17	
9	ZONE 9	22.89	10	
10	BCOO	6.00	2	
11	Fermentary	-	10	
12	Ground Maintenance	-	33	2
13	CFC/HPU	-	22	
14	**Total**	**-**	**176**	

C. ACHIEVEMENTS:

Plantation Activities: The plantation activities were effectively carried out in all the existing zones in the zones.

During the year under review, the covid- 19 pandemic and Industrial strike action affected our normal cultural farm practices. Nevertheless, skeletal activities which include harvesting of cocoa pods, and clearing of CRIN frontage, were carried out. After resumption, all farm activities such as harvesting, and processing of cocoa, and oil palm, weeding, pruning of old plots, clearing of access roads, removal of mistletoes, and chupons were carried out.

Detailed analysis of the harvested farm produce within the year under review is itemize below:

D. COCOA

ZONES	COCOA	KOLA	CASHEW	BANANA	PLANTAIN	REMARKS
1	6,969	-	16.7kg	163	4	
2	2,673	-	-	-	-	
3 & 4	1,106	48.8kg	-	-	-	
5	7,313	-	-	-	-	
6	3,011	-	-	-	-	
7	-	349	-	5	-	
8	14,081	-	-	-	-	
9	2,938	-	-	-	-	
CFC	985	-	-	-	-	Due to fire outbreak at CFC the output of the unit witness a setback because some percentage of the plots were wiped out
TOTAL	**39,074**	**397.8kg**	**16.7kg**	**168**	**4**	

CHALLENGES AND CONSTRAINTS:

- Shortage / inadequate supply of manpower greatly affects our production and maintenance activities.
- There is the need to revisit old and abandoned cocoa plots the way it was done the previous year.
- Porosity of zonal / unit office complex gives room for pilfering of farm produce.
- Delay in release of fund for the running of PEM.
- Late and inadequate supply of agro- chemicals allow over growing of weeds which compete with crops.
- Inadequate supply of farm tools and protective clothing materials.

- Monitoring / supervising exercise is difficult because of unavailability of functional motorcycle or utility vehicle.
- All the bazuki's tricycles attached to PEM are grounded.
- The zonal and unit leaders have no personal and conducive office to retire to after each day work from the farm.
- Lack of utility vehicle for easy movement of the Plantation Manager supervision and easy of evacuation of harvested farm produces.

CONCLUSION:

We thank God for being merciful to us and for seen us through the COVID -19 pandemic period. Also we deeply appreciate the Executive Director and the entire management for their support and encouragement from time to time. Thank Sir.

Thanks.

Adeyemo, R. F. (Mrs.)
Plantation Manager

NURSERY DEVELOPMENT AND MANAGEMENT SECTION

The Nursery section comprises of two units; Sexual propagation unit and Vegetative propagation unit. The activities of each unit in the year reported upon are as follows:

1. Sexual propagation unit (SPU): The following activities were carried out in this unit:

-Propagation of all mandate crops through sexual means

-Maintenance of seedlings of all mandate crops

-Maintenance of plantain orchard

-Supply of seedlings all mandate crops to farmers for commercial and research purposes

-Training of Students on industrial attachment, farmers on field trips, Students on excursion and other visitors

-General cleaning of Nursery and its environment

-Maintenance of WCF plot.

2. Vegetative propagation unit (VPU): The activities performed by this unit are as listed below:

-Vegetative propagation of all mandate crops through grafting, budding and stem cutting.

--Maintenance of all bud wood gardens.

-Maintenance of old cocoa clonal and seed gardens

-Establishment of new cocoa clonal garden for bud wood collection and seed collection purposes

-Supply of budded and grafted cocoa, cashew and kola to farmers and CRIN garden

-Training of visitors, students and farmers

-General maintenance of Nursery

3. Others activities carried out include:

-Rehabilitation of one number of shades net by the Management

-Successful vegetative propagation of kola and coffee stem cuttings for research purposes

-Successful grafting of cashew for field research purpose by cashew programme

-Provision of technical assistance on research activities as demanded by Research Scientists

4. Tools and Equipment: The following tools and equipment were given to the section for effective service delivery:

a. Chemicals: 1. Herbicide (clear weed and weed crusher)

2. Insecticides (termex)

b. Spraying pump

c. Spraying coat

d. Nose mask

e. Hand gloves

f. Wheel barrow

5. Training: All Nursery were trained except those who were not regular during the period

6. Staff strength: The staff strength of the section is 32 (5 supervisors and 28 Staff)

7. Achievement: The following achievement were recorded within the period reported upon:

-Sales of 182,402 hybrid cocoa seedlings to farmers

-Sales of 1,680 cashew seedlings

-Sales 3,628 of Kola seedlings

8. Challenges: The nursery section is being faced with some challenges in spite of the aforementioned achievement which include:

-Dilapidation of some shade nets

-Irregular transportation of staff to and fro Nursery

-Lack of security personnel

-Lack of office equipment/facilities and sufficient farm tools and equipment

9. Recommendation: More attention should be given to Nursery section in order to improve the production of healthy seedlings and clones.

Babalola E. A. (NDM)

SUBSTATIONS

AJASSOR SUBSTATION

Ajassor substation, was founded in the year 1965 as a Research Substation and Extension Centre to CRIN, Ibadan. CRIN Ajassor is located along Ikom –Ajassor Border Road near Cameroun Border in Etung Local Government Area of Cross River State of Nigeria. It is bounded in the West by Ikom township, South by Effraya town, North by Ajassor plantations (Etigefe) and East by Ajassor Mission town. CRIN Ajassor substation is predominantly cultivated with Cocoa but because of its soil fertility and ability to sustain most tree crops, some handful of plantations of Kola, Coffee and Tea are also located at the station. In fact, it is well established that Cashew can also thrive in CRIN Ajassor. Consequently, all the five mandate crops of CRIN can be grown on CRIN Ajassor soil.

CRIN Ajassor substation is the largest Substation with a landmark of about 768 hectares. This total land area which has been reported over the years is currently not certain due to mass encroachment of the border forest and plantations by the local native occupants/ communities.

In addition to the main substation in Ajassor, there are two other experimental outposts in Assena-sen community formerly referred to as (Okundi) located at Ikom-Okundi-Etome Road and

predominantly cultivated with Cocoa and Coffee while Kalime outpost is located along Ikom – Ajassor Border Road mainly cultivated with T.38 clone of Cocoa.

Table 1: UPDATED LIST OF AJASSOR SUB-STATION STAFF IN ORDER OF SENIORITY AS AT 31ST DECEMBER, 2021

S/N	Name	PF No.	CONRAISS and step as at 31/12/2021	Designation	Date of 1st appointment
1.	Dr. Eghosa Osas Uwagboe	251	13/03	Chief Research Officer (Head of Station)	11/12/2001
2.	Mr. Samson O. Odedele	314	12/02	Asst. Chief Agric Superintendent	08/04/2008
3.	Mr Ajayi Oluwaseun	375	11/03	Principal Agric. Superintendent II	2/2/2009
4.	Mrs. Joy Awunghe Takim	390	09/03	Principal Nursing Sister I	01/04/2010
5.	Mr. Nmeregini Uwadiaru	1206	08/03	Accountant II	17/07/1995
6.	Mrs. Esther Ntomo Echi	1293	07/03	Chief Health Asst.	01/12/1997
7.	Mrs. Maureen Duruaku	1897	07/01	Acct. II	05/12/2011
8.	Ms. Pauline Ukpeukiema Ugi	1566	07/01	Senior Secretariat Asst. I	23/12/2008
9.	Mrs. Blessing Ekama Isong	1288	06/11	Chief Clerical Officer	01/12/1997
10.	Mr. Ezekiel Asuquo Effiong	1289	06/04	Chief Agric Overseer	01/12/1997
11.	Mr. Edet Akpan Robson	1541	06/04	Chief Agric. Overseer	02/06/2003
12.	Mr. James Ibiang Okoi	1543	06/04	Snr Foreman	10/06/2003
13.	Mr. Okpokam Ozong Edim	1556	06/04	Chief Store Keeper	10/04/2008
14.	Miss Precious Magagi	1820	06/02	Chief Clerical Officer	06/07/2011
15.	Mr. Sunday Nkanta Ekereobong	1700	06/01	Chief Field Overseer (Security)	02/01/2009
16.	Mr. Abraham Samuel Inyang	1701	06/01	Chief Field Overseer	02/01/2009
17.	Mr. Samuel James Udoh	1702	06/01	Chief Field Overseer	02/01/2009

18.	Mr. Idagu Godwin Echa	1703	06/01	Chief Field Overseer	02/01/2009
19.	Mr. Onah Peter Ogar	1704	06/01	Chief Field Overseer	02/01/2009
20.	Mr. Iwara Eteng Okoi	1706	06/01	Chief Field Overseer	02/01/2009
21.	Mr. Sunday Ime Asua	1705	05/02	Asst. Chief Agric Field Overseer	02/01/2009
22.	Mr. Azogor Isong Echeng	1707	05/02	Asst. Chief Agric Field Overseer	02/01/2009
23.	Mr Augustine Eteng Ubi	1698	05/02	Asst. Chief Agric Field Overseer	02/01/2009
24.	Mr. Emeng Ele Eleng	1708	05/02	Asst. Chief Agric Field Overseer (Security)	02/01/2009
25.	Ms. Mercy Umontia	1814	05/02	Asst. Chief Agric Field Overseer	29/04/2011
26.	Mr. Peter Godwin	1815	05/02	Asst. Chief Agric Field Overseer (Security)	29/04/2011
27.	Mr. Idorenyin Okpo	1950	04/05	Senior Agric Field Overseer	26/04/2012
28.	Mr. Anthony David	1816	03/09	Agric Field Attendant 1	29/04/2011
29.	Mr Monday Echi Enya	1974	02/02	Driver/Mechanic II	5/3/2020
30.	Miss Patience Takon Ayiba	1978	01/02	Agric. Field Attendant III	5/3/2020
31.	Mr Emmanuel Takon Ayiba	1979	01/02	Agric. Field Attendant III	5/3/2020

Staff Disposition

As at 31 December 2021 the staff strength across different sections were 31 including the Head of Station who is a Research Officer, 2 Agricultural Superintendents, 2 Chief Clerical Officers (Administration), 2 Accountants II, 1 Store Keeper, 1 Principal Nursing Sister I, 1 Health Asst, 1 Senior Secretariat Asst. I, 1 Foreman, 3 Security men, 15 Field officers, 1 Mechanic/Driver. It is pertinent to inform CRIN Management that most staff of CRIN Ajassor, especially those on the field and in the Security Section are very few and mostly old people. There is an urgent need to recruit more young and vibrant persons into the system.

Table 2: Staff who left CRIN Ajassor Sub-station in 2021

S/N	Name	Designation	Date of Exit	Cause of Exit
1.	Mrs. Eunice O. Ojua.	Senior Executive Officer (Acct.)	16/7/2021	Retirement
2	Mr. Effiong Nathaniel Udoh .	Senior Foreman	16/7/2021	Retirement
3	Mr. Udoh Akpan Johnny	Senior Agric Field Overseer (Security)	22/12/2021	Death

Table 3: Research experimental work on-going at Ajassor Sub-station in 2021.

Cocoa Research Plots	Hectares	Status
Cocoa plots		
1967 Trinidad	2.9	Abadoned
1975 F_3 Amazon	1.6	Abandoned
CRIN/NIFOR 1	6.0	Abandoned
CRIN Elite Seed Multiplication	2.2	Maintained
T38 Kalime	2.8	Maintained
Commercial 1	2.0	Abandoned
Cocoa Cuttings	1.0	Maintained
15 Acres Extension	2.0	Abandoned
Amelonado	2.0	Maintained
1973 F_3 Amazon	2.0	Abandoned
Seed Garden Multiplication	2.2	Maintained
Okondi	10.69	Maintained
Planting at stake	1.6	Maintained
Farming System Experiment	2.0	Maintained
Adaptability/Tolerant Trial	2.1	Maintained
65 Lines Experiments	1.0	Abandoned
CRIN Elite Seed Multiplication	2.2	Maintained
Cocoa Research Plot	1.32	Maintained
Ornamental Cocoa Plot	0.5	Maintained
Okundi (Cocoa) Plot	0.4	Maintained
Kola Research Plots		
Kola Progeny	1.6	Moribund
Kola Cuttings	0.65	Maintained
Kola Germplasm	2.92	Maintained
Kola Fertilizer Trials	2.0	Abandoned
Coffee Research Plots		
Okundi	1.46	Moribund
1989 Ajassor	1.57	Moribund
Tea Research Plots		
Tea Ajassor	0.28	Abandoned

Table 5: Plantations/ Research plots with their hectares and maintenance status in Ajassor as at 31 December 2021

Plantation Management

There were various challenges such as inadequate labour force (field workers) as well as unavailability of enough agro-chemicals for field and ground maintenance. Inadequate cultural maintenance of all the Cocoa, Coffee, Kola and Tea plots under CRIN Ajassor were done throughout the period under review due to the covid-19 pandemic and National Trade Union Dispute which made workers to be on strike.

Remark: The effective hectarage for the crops is not certain as proper survey has not been carried out. Some of the abandoned cocoa plots were put under sharecropping to enhance increase in revenue and prevent spread of pests

RESEARCH EXPERIMENTS

A pocket of research experiments were on-going at CRIN Ajassor Substation as at 31 December, 2021 as indicated in Table 5 below

Infrastructure/Capital Projects

CRIN Ajassor didn't receive any capital fund for project in the period (2021) under review. The slab and tarpaulin are obsolete and non-presentable. We recommend their replacement with more recent and highly acceptable raised platforms and durable tarpaulin. The 3 shade nets for raising seedlings need urgent replacement as they are in a very bad condition. The roofing of the administrative block is leaking and the ceilings are collapsing.

Environmental Sanitation

At CRIN Ajassor, we know that ‘health is wealth’ and so we placed a high premium on the cleanliness of our offices and the residential quarters. Against this backdrop, a Monthly Environmental Sanitation was carried out on every last Saturday of the month throughout the year under review. We also implore CRIN management to provide more public toilets for the staff in their residential quarters in 2022.

List of the vehicles/motorcycles/generators/other equipment and their conditions are as below:

1. Toyota Hilux Van with registration number FG 09 V03 (Not functioning. Recommended for auction).

2. 404 Pick-Up with registration number FG 2326 B034 (not functioning; recommended for auction).

3. Mercedes 911 Water Tanker with registration number FG 237 B02 (functioning but below optimal level; should be overhauled as soon as possible).

4. The Eicher Truck with registration number FG 740 B03 (Not functioning. Recommended for auction).

5. Mitsubishi L200 Van with registration number FG 741 B03 (not functioning but could be repaired for the use of CRIN Ajassor Substation).

6. Bedford with registration number FG 238 BO3 (already a scrap; recommended for auction)

7. Tractor 1 (serviceable) with registration number FG 239 B03 MF 265 (functioning but its tires and few parts needed replacement).

8. Tractor 2 (unserviceable) already a scrap; recommended for auction.

9. Motor-cycles 3: We have 1 Daylong Wolf 150 it's not functioning due to accident while on official assignment but the 2 Suzuki 185 motor bikes with registration numbers FG 334 B03 and FG 335 B03 are old and not functioning, and are recommended for auction

10. 1 Tricycle Bazuki 200 TRC (functioning. Needs servicing)

11. Generators: 50 KVA Generator plant 1 (functioning but some of its parts needed replacement), 1 Elepaq 10KVA Petrol generator functional, 1 Tiger 2700 (functioning), 1 Sumec SPG 2500 (functioning) and 1 Tiger T 950 (functioning)

12. Farm/Field equipment: 1 Hand driven mower, 1 Hand mower, 1 Water pump, 1 Harrow, 1 Plough, 1 Ridger

13. Visual equipment: 1 Overhead projector DLP LG,

14. Laboratory Equipment: 1 Autoclave, 1 Micrscope

15. Electronic machines: 1 HP Scanner G4010 (functioning), 1 HP Printer P1006 (Faulty), 2 HP Laptops, 3 HP Laserjet printer (2 faulty, 1 functioning), 1 Desktop computer (Samsung) (Faulty)

Visitors to the Substation in 2021.

More than 150 visitors came to CRIN Ajassor sub-station in 2021 but only 20 of them were sampled for this report. The names, addresses and purpose of visit of the sampled visitors are reflected in Table 6.

Table 6: Name, address and purpose of visitation of some sampled visitors to CRIN Ajassor sub-station in 2021

S/N	Date	Names	Address	Purpose
1.	9/1/2020	Maria Eju	Ajassor	Official
2.	12/01/2020	Odo Joshua	Ikom	Official
3.	15/2/2020	Gertrude Osadim	PHC	Official
4.	21/2/2020	Olouyole, K. A.	CRIN hqtrs, Ibadan	Official

5.	16/3/2020	Taiwo, O. A.	,,	Official
6.	26/3/2020	Borjor Obi	Ekimaya	Cocoa pods
7.	24/4/2020	Loe Ati	Ikom	Cocoa pods
8.	28/4/2020	Ogar Oscar	Ikom	Cocoa pods
9.	10/5/2020	Osang Lawrence	WCS	Cocoa seedlings
10.	18/5/2020	Patrick Isong	Water falls	Cocoa pods
11.	18/6/2020	Sunday Ova	WCS	Cocoa seedlings
12.	23/6/2020	Abua Jonas	Police Etung	Official
13.	27/6/2020	Okozi Jude	Boki	Test
14.	02/7/2020	Joseph K	Hqtrs	Official
15.	17/7/202	Accoyin K.N	Nde Ikom	Personal
16.	14/8/2020	Sunday Okpikan	Ikom	Cocoa seedlings
17.	18/8/2020	Mbang **Oboyi**	Obubura	Cocoa seedlings
18.	6/9/2020	Faith Echeng	Ikom	Personal
19.	25/9/2020	John Ojang Agbor	Bashua	Personal
20.	13/10/2020	Sam Eko	Ekori	Cocoa seedlings
21.	13/10/2020	OK Nyam	Yala	Cocoa pods
22.	7/11/2020	George Arrume	Edor	Cocoa pods
23.	20/11/2020	Agbor Edotri	Mfum border	Cocoa pods
24.	2/12/2020	Dr. Adebiyi S	CRIN Hqtrs	Official
25.	4/12/2020	Dr. Abua K. B.	Calabar	Official
26.	18/12/2020	Mr Etuk Ntim	Ikom	Cocoa pods

Internally Generated Revenue for 2021

A total amount of One Million, One Hundred and Twenty One Thousand and Three Hundred Naira (**₦1, 121,300**) only was generated by CRIN Ajassor Sub-station in 2021. The breakdown of the revenue generated is in Table 7 below:

Table 7: Internally Generated Revenue (₦) Analysis for 2021 (January-December)

S/N	Items	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1.	Cocoa pods				**200,000**								**635,100**	**835,100**
2.	Processed Cocoa dry beans							**51,200**					**60,000**	**111,200**
3.	Cocoa seedlings											**100,000**		**100,000**
4.	Kola nuts				**5,000**									**5,000**
	Non-produce													
1.	Rents								**70,000**					**70,000**
	TOTAL													**N1,121,300**

Challenges and Prospects

Some of the challenges and prospects in CRIN Ajassor Substation are as follows:

Internally Generated Revenue (IGR): It was observed that revenue reduced this period (2021) due to Covid-19 pandemic, workers strike, inadequate field workers, intensive heat resulting from climate change. Hired labour was used to open up some of the abandoned plots for share cropping in late 2021 in order to increase IGR for the station in subsequent years.

Inadequate workforce: We are the largest substation in CRIN yet with only 15 Field staff. We need more staff to adequately maintain all our plots and watch over them. The substation has the capacity for expansion and increased productivity if more staff is engaged. This problem has resulted into the situation where most of our productive plantations are abandoned which, of course, gives room for pilfering of our farm produce, more encroachment and much lower productivity. We urgently need to salvage the situation and produce at our optimal level. To this end, CRIN Ajassor requires nothing less than 60 field staff to cope with the weeding, spraying, harvesting, pruning and other cultural practices on our cocoa, kola, coffee and tea plots. Therefore, there is a need to employ additional 45 Field Attendants to complement the existing 15 Field Staff.

Besides, in order to effectively secure lives, properties and forestall against theft of our farm produce, we need additional 20 Watchmen to complement our 4 current Watchmen at the moment.

Funds: There was no capital fund released to the station in 2021. We use this medium to appeal for Overheads and Capital Votes to CRIN Ajassor Sub-Station as soon as possible. It is extremely difficult to run a Substation with 31 Staff without overheads. We need to repair and fuel our Toyota Hilux, Tractor, Water Tanker as well as Bazuki, machines, equipment and generators especially as we

mobilize our field men to go into our 3 outposts at Assena-sen (Okundi). Rantimankonor near Kalime and NIFOR. We are already struggling to meet our target of higher revenue next year but it is already becoming extremely difficult without enough funds, Union trade dispute and the Covid-19 pandemic.

Training/Workshop: A training/Workshop was organized for Cocoa farmers on creation of awareness of CRIN developed technologies at Effraya IN Etung Local Government Area and Akparabong in Ikom Local Government Area in Cross River State on 24th and 25th November, 2021 respectively at Council Hall Effraya and Unity Town Hall Akparabong. Some issues that needed to be attended to which generated from the workshop include; availability of CRIN products and training on the processing of the products in the cocoa growing communities, more extension services required in the cocoa growing areas etc.

Encroachment on CRIN Ajassor sub-station land by Ajassor indigenes

This act kept on reoccurring over the years and there has been series of reports by OICs and HOSs on this issue to the headquarters which is yet to be addressed holistically. Several meetings have been held by the current HOS with some of the encroachers to abstain from the land but they kept on increasing by the day. A form was designed by Legal unit at CRIN headquarters to distribute to the encroachers willing to crop arables and to pay a token which was rejected as they insisted on planting cocoa on the land. A proposal of GIS survey project to know the extent of CRIN land was made to the Institute by the HOS (Dr. Uwagboe), Mr Obatolu and Dr. Ogunwolu (HOD Sub-station) in 2019 but it was not approved. I wish to appeal that this new management revisit that proposal for execution.

Other pressing needs of CRIN Ajassor Substation:

1. Vehicles: One new Hilux Pick-up Van and one 18-Seater Staff Bus
2. Motorbikes: Based on the volume of the field work and the need for constant patrol of our plots by the security, there is a need to have 5 functioning motorbikes at our substation.
3. Quick intervention by CRIN Headquarters on the issue of completing the connection of CRIN Ajassor sub-station transformer to National Grid by Port-Harcourt Electricity Distributor (PHED). So much money has been spent on this issue and yet the PHED has refused to complete the job to enable us have electricity at the station.
4. Surveying and fencing of the station: Surveying of our lands is the only way CRIN can permanently stop the encroachment problem presently being faced by the station. Wire or Perimeter fencing with Oil-palm will also be an added advantage.
5. Construction of concrete and metallic sign posts in all plots for easy identification of name of plants, year of establishment, varieties of plant used, size of each plot, location and general history of all our plots and plants.
6. Tarring or grading of 1km road from Border road to CRIN Ajassor main gate which is becoming unmotorable.
7. An internet connection: This could be a broadband internet facility that will facilitate speedy surfing of the web and transfer of research related information to the headquarters. This will help the station to key into the present policy of internet administration strategy in CRIN.
8. Renovation of residential quarters: The buildings at CRIN Ajassor are all dilapidated while toilet facilities are becoming a mirage. Although, government quarters had been monetized, an urgent rescue mission on our Residential buildings to avoid total collapse of these 'farm

houses'. Once collapsed, the tenants and staff will move out of the quarters and that will spell doom for the safety of all farm produce at the station.

9. Construction of farm houses in the zones for the field workers to serve as coverage during rainy season.
10. Renovation of nursery seedling shade nets which are in very bad state.
11. Installation of inverter at the station to bring down the running cost on gasoline/diesel operated generator.
12. Repairs of meteorological station which quotation has been submitted and awaiting approval
13. Re-printing and painting of the CRIN Ajassor Sub-station sign post at the entrance of the station
14. Renovation of the fermentation house, purchase of tarpaulin for drying of cocoa beans, drying oven shed and construction of raised platforms for drying cocoa.
15. Provision of a modern and better equipped laboratory for CRIN Ajassor.
16. Completion of Cocoa bread bakery in the station
17. Repairs of leaking roof of the administrative block building.

OWENA SUBSTATION

Head of Station: Dr. O.S.O., AKANBI

Staff Disposition List: The staff list at the station during the year 2021 is as shown below

S/N	Designation	Owena	Alade	Onisere
1	Chief Research Officer	1		
2	Assistant Chief Agric. Superintendent	1		
2	Principal Agric. Superintendent 1	2		
3	Principal Executive Officer I	1		
4	Chief Health Assistant	1		
5	Higher Executive Officer	2		
6	Executive Officer	1		
7	Work Superintendent	1		
8	Chief Agric. Field Overseer (CAFO)	4		1
9	Asst. Chief Agric. Field Overseer (ACAFO)	4		
10	Senior Motor Driver Mechanic Grade 1	1		
11	Senior Agric. Field Overseer	1		
12	Agric. Field Attendant 1	3	1	
13	Agric. Field Attendant II	2		
	Total	**25**	**1**	**1**

Land Area:
At Owena main Substation, the size of all the plantations is 17.95ha but the effective hectarage is 10.4ha; at Alade Outstation, the total hectarage is 0.5ha and the effective

hectarage is 0.3ha while at Onisere Outstation, the total hectarage is 2.5ha and the effective hectarage is 1.0ha.

Activities:
On-going Research: Some of the experiments under the station's supervision include:

1. Continuation of Cocoa Soils core trial (Dr. Ogunlade *et al.*)
2. Continuation of experiment on "Evaluation of field establishment of tea under shade plant and organic manure and low cocoa ecology of Nigeria" (By Mr. Adeosun, S)
3. Completion of Life mulch weeds control system on the development and growth of seedling of cocoa (By Mr. Idrisu Muhammed)
4. Ongoing Research on Genetic diversity studies on Robusta coffee (***Coffea canephora***) assisted by molecular markers (By Mr. Muhammed Baba-Nitsa)
5. Fungicide screening activities were carried out to determine the efficacy of fungicides (Mackezien Gold and Prolab)

Achievements:

1. Training of 500 students from Adeyemi College of Education, Ondo, Ondo state on Nursery practices
2. Training of delegates of foundation for partnership initiative on the Niger Delta (PIND) on Nursery activities of cocoa seedlings
3. Construction of cocoa bread factory in the Station (Owena)
4. Maintenance of all plantation at Owena main Station and out station with little resource and available labour.
5. Creation of awareness on CRIN product to market women in Akure by Scientists from Extension and end use Research Department.
6. Raising and distribution of 40,000 Cocoa seedling to Nigeria Cocoa farmers

Revenue:
A total sum of One million, five hundred and forty nine thousand, one hundred and twenty naira only (₦1, 549,120.00) was realized from the sales of farm produce and other services. This is an improvement over the previous year's own.

Challenges/Constraints:
1. Illegal excavation of CRIN Agricultural land and encroachment on the station's landed properties
2. Paucity of Fund: There is paucity of fund and this affects the station negatively. Station's overhead which cares for the expenses of the day to day running of the station is not forthcoming and this makes the running of the station very difficult.
3. CRIN/FRIN Boundaries dispute: This crisis has lingered on for too long without any reasonable resolution.
4. Shortage of Field Workers: Considering the enormity of the work in our plantation, the present field staff is grossly inadequate to take care of the work. There is a total of six (6) field staff to manage 15ha of cocoa plantations. These are grossly inadequate.
5. Shortage of Security Staff: The present number of security staff is inadequate for effective guarding of the office, staff quarters and plantations.
6. Poor state of CRIN Staff Quarters Road: The road linking the staff quarters with the office is totally spoilt and this makes it difficult to be plied by vehicles.

Suggestions for improvement

1. The overhead should be reviewed upward and made available on time to cater for some urgent and pressing issues. This will make the administration of each substation easy.
2. The Substation's guest house needs a light renovation in order to make it a more habitable for our researchers that are coming from the headquarters to carry out research work at the substation.
3. Rehabilitation of most of our cocoa plantations to guide against total loss of the cocoa trees
4. Shortage of field staff: Considering the enormity of the work in our plantations, there is a need for more farm workers to complement the few numbers on ground.
The additional staff request by cadre is as follows:

Field Attendant 1	4
Field Attendant II	8
Security Guards	4

However, if the above categories of workers are not available, it will be highly appreciated if we can be allowed to recruit contract workers to replace them.

APPENDIX

2020 INTERNALLY GENERATED REVENUE

Items	N
Cocoa Beans	407,380
Cocoa Pods	852,450
Cocoa Seedlings	50,000
Rent	189,250
Rest House	40,000
Damages	10,000
TOTAL	**N1,549,120**

Visitors:
Prominent among the visitors to the station in the year 2021

1. Director of Extension Service Federal Ministry of Agriculture
2. Executive Director CRIN Dr. P.O Adebola
3. 500 Student from Adeyemi College of Education
4. Dr. S.O Agbeniyi
5. Dr. Famaye A.O
6. Dr. F.O olasupo
7. Babalola E.A (Mrs.)

OCHAJA SUBSTATION

Staff Disposition/Human Resources: As at end of the the year 2021, the staff strength of the substation under review \remains 28 with the transfer of new Head of station (Dr. D.O. Adeniyi) who reported on 1st February 2021.

S/N	Names	Designation	Responsibility	Remark
	Senior Staff category			
1	Dr. D.O. Adeniyi	CRO/GL13	Head of Station	
2	Mr. Uloko B.A.	CAS/GL13	Field officer	
3	Mr. Elugbe M.O.	ACAS/GL12	Field officer	To retire 2022
4	Mr. Okonta Patrick	PAS I/GL11	Field officer	
5	Mr. Magaji Muhammed	PAS I/GL11	Field officer	
6	Mr. Ibrahim Wasiu A.	SEO-Acct/GL08	Office	
7	Mr. Musa Ibrahim Y.	ASEO-Acct/GL07	Office/Store	
8	Mrs. Samuel Ladi E.	SSA I/GL07	Office/Secretary	
9	Mr. Oguche Nathaniel	CAFO/GL06	Field officer	
10	Mr. Ibrahim Noah	CD/MECH/GL06	Office/Driver	
11	Mr. Opaluwa Pius	CAFO/GL06	Field officer	
	Junior Staff category			
12	Mrs. Aye Fatima	SAS/GL05	Field	
13	Mrs. Abah Janet	SHHA/GL05	Office	
14	Mr. Musa Abdullahi	ACAFO/GL05	Field	
15	Mr. Alih Muhammed	ACAFO/GL05	Field	
16	Mrs. Yahaya Musa A.	ACAFO/GL05	Field	
17	Mr. Nda Okpanachi	ACAFO/GL05	Field	
18	Mr. Alfa Ndah	ACAFO/GL05	Field	
19	Mr. Attah Ojone	AFA I/GL03	Field	To retire 2022
20	Mr. Unubi Attah	AFA I/GL03	Field	
21	Mr. Alu Friday	AFA I/GL03	Field	
22	Mr. Atawodi Jibrin	AFA I/GL03	Watchman	
23	Mr. Otanwa John	AFA I/GL03	Watchman	
24	Mr. Nifu Yahaya	AFA I/GL03	Field	
25	Mr. Husseni Yahaya	AFA I/GL03	Field	
26	Mr. Abubakar Yahaya	AFA I/GL03	Field	
27	Mr. Simon Sunday	AAFO II/GL02	Field	
28	Mr. Umoru James	AAFO II/GL02	Field	

1. Land Resource/Asset

The Substation has a total land mass of 351 hectares, out of this land mass, about 70 hectares had been cropped mainly with cashew and some other crops like kola, oil palm and arable crops. About 17 hectares of this land had been encroached upon by the indigenes. The table below shows the details of the land mass and its usage in the Substation with regards to plot names and hectarage:

2. **Land Resource and Utilization**

- Total land coverage of the Substation: 351 Hectares
- Total land area already cropped with cashew: 59.2 Hectares
- Total land area encroached upon by Indigenes: 17 Hectares
- Newly cultivated Cashew Plot in 2021: 3.2 Hectares

Total land area under permanent crops cultivation: 71.2 Hectares:

3. **Plantation Management/Activities:**

a. Maintenance of Research plot: The period under review had hired labour (engaged through funding from the headquarters) in plantation clearing to minimize competition by weeds and reducing weed density on research and commercial plots. The activities were carried out timely in preparation for cashew fruiting season of 2021 and satisfactorily delivered.
b. Pruning: Regular removal of chupons and unwanted outgrowth was carried out on commercial cashew plots on the plantation.
c. Fire Traces**:** Fire tracing all-round some plantations to check fire outbreak of fire incidence which started in December 2020 was carried out also in January 2021.
d. The stations Boundaries**:** The substation boundaries were re-visited and the staff quarters boundaries were well maintained, however record of land encroachments and unauthorized access to the land were recorded.
e. Nursery: The temporary nursery site of the station, was cleared of over-grown and uncollected cashew seedlings and made ready for new season activities.
f. Weather station: The weather station was being resuscitated for adequate record keeping of weather parameters.
g. Touring of facility at Ochaja: A tour of CRIN facilities, research, trial and commercial plots as well as boundaries showed that about one hundred (100) hectares of our facilities have been encroached with close proximity to research plots.

4. **Research/Activities:**

a. The 19 cashew plots were maintained although with some level of difficulties and prepared for ease of nut picking during the fruiting season of year 2021.
b. On-going research experimental plots were maintained in collaboration with the scientists involved. Some of the experiments under the station's supervision include:
c. Participated in the facilitation of cashew farmers training sponsored by APPEALS project in Kogi state.
d. Raising of cashew seedlings and distribution to the three Senatorial Districts of Kogi state (APPEALS project).
e. Facilitation of GAP training for cashew farmers through APPEALS project
f. Facilitation of training for cashew farmers in Kogi East (PROCashew-Nigeria project).
g. Resuscitation of One (1) hectare of fire gutted plot was reopened for research activities.
h. Biochar trial and cashew intercrop; Research study by Ibiremo O.S., Ogunlade M.O., Adeyemi E.A., Akanbi O.S.O.
i. Peelable cashew project by Olasupo F.O., Adeniyi D.O., Adeigbe O.O.
j. Delivery of 500kg of raw nut (jumbo, large & medium) to Department of Production and Substation, headquarters, Ibadan.

5. **New Cashew plot establishment:**

a. Establishment of 2.0 hectares of polyclonal cashew seeds of Ghana and Tanzania origins with 9m-by-9m tree spacing.
b. Establishment of 0.5 hectare of polyclonal cashew seeds of Ghana and Tanzania origins with 12m-by-12m tree spacing.
c. Establishment of 0.7 hectare of Brazilian large cashew biotypes (Ochaja material) with 10m-by-10m tree spacing.

6. Visitor to the station:

a. Students field trip/excursion: Students of the Department of Agriculture, College of Agriculture, Ankpa, Kogi state were on study tour to the station. About 100 of them were guided round the research plots, nursery site and facilities of the station for knowledge sharing and mandate of the Institute and the research station.
b. Scientists from headquarter: Dr. Festus Olasupo, Mrs E.A. Adeyemi, Dr O.S.O. Akanbi, Mr Tony Agbongiarrhoyi, Dr Mrs Agunana.
c. Alhaji Adamu of the Kogi State College of Education, Ankpa.
d. Mr Olorunfemi and Prof Peter Masawe (Tanzania) both of the CNFA-PROCashew – Nigeria project.

7. Substation needs:

a. The substation needs alternative power source: 5KVA (office complex & 2KVA for HOS quarters).
b. Renovation of office complex and furniture for staff.
c. Security personnel and watch light to oversee research plots and staff quarters
d. Printing gadget (Printer, Photocopy machine, scanner) and stationeries.
e. Funding is strongly solicited for in form of “overhead” for very pressing needs at the station.

8. Achievements:

a. Efforts were made to maintain research and commercial plots at the substation with the little resources and available labour.
b. Establishment of 2.0 hectares of polyclonal cashew seeds of Ghana and Tanzania origins with 9m-by-9m tree spacing.
c. Establishment of 0.5 hectare of polyclonal cashew seeds of Ghana and Tanzania origins with 12m-by-12m tree spacing.

9. Challenges/Constraints:

a. There is paucity of fund and this affects the station negatively. Station’s overhead which cares for the expenses of the day to day running of the station is not forthcoming and this makes the running of the station very difficult.
b. The current number of field officer are grossly inadequate compare to the magnitude of work to be carried out.
c. Security is a major challenge at the substation, security personnel are small to effectively man the research plots, office and staff quarters.
d. Incessant theft of farm produce (raw cashew nut, oil palm) on the field.
e. The major road linking the office to the express road is totally out of use and the alternative route requires serious attention for clearing because it is difficult to be plied by vehicles.
f. The encroachment of CRIN facility in Ochaja and incidences of theft continue to be a major challenge to manage as staff are being threatened and attacked on the field on regular bases.

g. The institute should plan a perimeter fencing and re-survey of the entire land belonging to Ochaja substation as contention over the land get worsened.

10. Suggestions for improvement

a. The 'overhead' should be disbursed regularly to substations

b. Alternative power supply (inverter, solar panel) should be installed in office complex for ease of administrative and research work at the station.

c. Solar powered security light should be installed round office complex to the staff quarter to help in the fight against theft and insecurity in the area.

d. More field workers should be engaged for effective management of our plantations.

11. Request

Field Attendant I (10), Field Attendant II (10), Security Guards (8).

Approval to recruit contract workers to serve in the above capacity.

12. Internal Generated Revenue (IGR): The sum of One million, two hundred and twenty seven thousand, eight hundred naira (₦1,227,800) only, was the total amount remitted to Institute account as internally generated revenue for the sub-station during in the year 2021. The breakdown of revenue generated as shown below.

Summary of Internal Generated Revenue (January – December 2021)

S/N	DATE	DETAILS	AMOUNT (₦)
1	04/06/2021	Sales of 12kg cashew nut at 1,500 each	18,000
2	04/06/2021	Sales of 15kg jumbo and 15 kg medium cashew nut at 1,500 and 1,000 respectively	37,500
3	04/06/2021	Sales of 300 kg cashew nut at 350 each	105,000
4	04/06/2021	Farm land rent	10,000
5	15/07/2021	Sales of 250 bunches of palm at 150 each	37,500
6	15/07/2021	House rent	16,000
7	08/04/2021	Sales of 1,154 kg cashew nut at 220 each	253,880
		Total (A)	**₦477,880**

Value of Produce Sent to Headquarters

1	DATE	DETAILS	AMOUNT
1	31/12/2021	500 KG of cashew nut @ 1500 per kg	750,000

Actual revenue generated from Jan-Dec' 2021 A+B +c = **₦1,227,800**

MAMBILLA SUBSTATION KUSUKU

A. PLANTATION:

1. **Weed Control:** Coffee, Tea and Cacao Plots: Periodic weed control exercises were carried out during the quarter at the respective research plots and other holdings as indicated. Hired labour was engaged in plantation clearing of weeds aimed at reducing weed density and the activity was carried out satisfactorily on plots. This was augmented with approximately 80 litres of systemic herbicide (Glyphosate) so as to reasonably manage the weed incidences at the

various fields. Clearing of cocoa seed garden and bud wood was also carried out during the period under review.

2. **Pruning:** In line with agronomic practices the tea and coffee germplasm plots comprising of were pruned to improve the yield plants. This yield includes leaves as well as materials for cuttings. This eventually enhanced uniformity of the plucking table for the tea plants and to encourage fresh shoots to boost high yield. The chupons were removed from the coffee plants for similar purpose and to prevent them from wild growth.

3. **Cocoa Plot:** The normal routine maintenance activities, which comprises of removal of chupons, mistletoes climbers, dead branches, epiphytes and harvesting of cocoa pods were carried out during the period of this report.

4. **Disease Control**: During the period, 15 sachets of fungicides (ultmax plus) were sprayed on cocoa trees against black pod disease infection.

5. **Cocoa Seed/Budwood Garden:** The World Cocoa Foundation/African Cocoa Initiative/CRIN (WCF/ACI/CRIN) which was established 2012 needs urgent attention as no fund has been release its for maintenance for about the past 5 years. Partial maintenance of the 2 plots of cocoa bud wood and seed garden was carried out using manual method of weed control during the year under review.

6. **Fire Tracing**: The fire tracing all-round the plantation to check fire outbreak which activity started in December 2020 was completed in January, 2021. This same activity was carried out in December 2021.

7. **Nursery**: The nursery of the station, which is the heart beat of the plantation, was well maintained with the following activities carried out in the nursery. Regular watering of the young tea seedlings and the old coffee and tea few seedlings were carried out. In addition, hardening of tea seedlings in the tent, which were raised by some scientists from CRIN Headquarters for their research purpose, started and was completed during the year in review and with a very high level of survival of the seedlings and clones.

The nursery unit issued out a total of 224 cacao seedlings and 228 coffee seedlings for gapping-up purpose in the field, while a good number of seedlings are still being maintained in the nursery. Other routine activities were carried out in the nursery, which also included supporting research scientists from the headquarters in raising seedlings and clones of their respective crop of research interest. Various research interest of different research scientists from the Headquarters were attended to at the nursery, including the request of Dr. A. A. Adeosun's

request to raise 1,560 cuttings among others. Fund presented by Dr Adeosun was used to construct another nursery shed from degradable plant materials.

8. **Office/Rest House Premises:** During the quarter, the office and the station's Rest House premises were well maintained to keep the surrounding clean.

B. RESEARCH ACTIVITIES:

The 8 experiments sited on the station were well maintained and data records collected when due and sent to the scientist concerned under request during the period under review.

The list of the experiments is shown in Table 1 below:

S/N0	TITLE OF EXPERIMENT	SIZE	YEAR	RESEARCHER	REMARKS
1	The effect of varying levels of organic and in organic fertilizers on growth of coffee Arabica seedlings.	0.5	2009	Dr. Ipinmoroti	In progress
2	Evaluation of nutrients supplement on tea production	0.5	2009	Mr. Daniel	In progress
3	Setting of 75 Nigerian/China (NGC) 1-5 Tea clone C15 cutting each		2012		
4	Sinulteneous selection and genotype x environment interaction of tea in Nigeria Kusuku	0.048	2014	Mr. Olaniyi O.O.	In progress
5	Effect of Neem fortified fertilizers on tea yield.	0.048	2015	Mr. Olaniyi O.O.	In progress
6	Effect of tea yield in the open and under the eucalyptus intercrop.	-	2015	Dr. Ipinmoroti	In progress
7	Sunulteneous selection and genotype environment interaction of tea in Nigeria (11) Mayo-selbe	0.048	2016	Dr. Olaniyi O.O.	In progress
8	The effect of diseases on coffee Arabica	-	2016	Dr. Orisajo	In progress

C. INTERNALLY GENERATED REVENUE (IGR):

The sum of one hundred and fifty-six thousand, six hundred and seventy-five naira (N156,675) was generated as Revenue for the year 2021 and the summary of the breakdown of the IGR is stated below on appendix Table 2 below

Table 2. SUMMARY OF INTERNALLY GENERATED REVENUE (IGR) FROM JANUARY 2021– DECEMBER 2021

ITEMS	JAN. 2021	FEB. 2021	MAR. 2021	APR 2021	MAY 2021	JUNE 2O21	JULY 2021	AUG 2021	SEPT 2021	OCT 2021	NOV. 2021	DEC. 2021	TOTAL
Rented Qty	3,125	6,250	625	-	1,875	-	-	-	-	-	-	-	11,875
Banana	1,000	1,200	1,000	2,200	600	-	-	-	-	-	-	-	6,000
Green Tea	-	10,000	-	-	30,000	-	-	30,000	-	-	-	-	70,000
Cocoa Beans	-	60,000	-	-	-	-	-	-	-	-	-	-	60,000
Pear Avocado	-	-	-	1,200	7,600	-	-	-	-	-	-	-	8,800
Total	**4,125**	**77,450**	**1,625**	**3,400**	**40,075**	**-**	**-**	**30,000**	**-**	**-**	**-**	**-**	**156,675**

HEALTH CARE SERVICE: Even though the dispensary of the station lacks drugs for optimal functioning health-related issues were handled at the station in the year under review and are hereby presented on a quarterly basis. Within the period, some ailments were diagnosed in the Station Dispensary. Some were treated and others referred to hospitals. The list of patient ill health cases treated is shown in the following tables:

Table 3. DISPENSARY REPORT: JANUARY-DECEMBER, 2021

DISEASES	JAN	FEB	MAR	APRIL	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
Malaria	25	15	30	11	18	6	4	2	-	7	-	-	118
Backpain	15	-	8	-	10	-	-	8	10	-	-	11	89
Cough	15	8	-	12	-	9	1	-	-	12	5	-	68
Catarrh	15	-	20	-	10	-	4	3	2	-	7	13	73
Heart burn	14	9	-	1	-	12	14	4	-	9	11	-	69
Body pain	11	6	7	-	-	21	-	-	10	-	-	20	75
Diarrhea	16	12	-	-	10	-	18	-	16	-	1	-	73
Sleepless night	15	-	13	-	-	15	-	-	1	-	-	-	44
Side pain	13	2	-	3	6	-	-	2	7	-	8	7	48
Vomiting	-	20	1	8	21	-	9	-	7	10	-	-	76
Typhoid fever	13	2	10	2	2	8	-	13	-	12	-	11	74
Cold	-	9	-	-	16	17	-	11	7	-	9	11	80
Stomach pain	8	8	-	-	11	-	12	-	14	-	19	-	59
Oedema	2	2	3	2	2	-	1	-	-	6	-	-	18
Neck pain	21	17	22	1	-	-	14	-	15	-	1	-	91
Hypetion	8	8	-	-	11	-	12	-	14	-	19	-	59
Headaches	16	12	-	-	10	-	18	-	16	-	1	-	73
Total	206	704	143	64	114	111	75	81	787	56	89	105	1,187

E. STAFF STRENGTH: The roll call of staffers at the Mambilla Substation during the year under review is presented below Table 4:

Table 4: Staffers at the Mambilla substation

S/N	NAME	DESIGNATION

1.	Dr. O. O. Adenuga	Head of Station
2.	Mr. F. N. Chila	Chief Agric. Supt.
3.	Mr. Jesse Mbonyel	Chief Agric. Supt.
4.	Mr. Augustine Mari	Asst. Chief Agric. Supt.
5.	Mr. Ayere Cletus	Statistician
6.	Mr. Abass Saheed Temilade	Station Accountant
7.	Mr. Peter Numfor	Chief Secretariat Assistant
8.	Mr. Francis J. Wakaps	Senior Technical Officer
9.	Mr. Jonathan Danladi Magaji	Higher Executive Officer (Store)
10.	Mr. Huseini Usman	Chief Health Assistant
11.	Mr. Ephesian Thomas	Chief Agric. Field Overseer
12.	Mrs. Anester Lawal	Chief Agric. Field Overseer
13.	Mr. Ahmed Zubairu	Chief Motor Driver/Mechanic
14.	Mr. Adamu T. Dahiru	Chief Motor Driver/Mechanic
15.	Mrs. Regina J. Isaiah	Chief Agric. Field Overseer
16.	Mr. Philippian Moses	Chief Agric. Field Overseer
17.	Mr. James N. Musa	Assist. Chief Agric. Field Overseer
18.	Mr. Zephaniah Numfat	Assist. Chief Agric. Field Overseer
19.	Mr. Joshua N. Paul	Assist. Chief Agric. Field Overseer
20.	Mr. Ahmed S. Buba	Assist. Chief Agric. Field Overseer
21.	Mrs. Philina Stephen	Agric. Field Attendant I
22.	Mrs. Satu Musa	Agric. Field Attendant I
23.	Mr. Joseph Nuki	Agric. Field Attendant I
24.	Mr. Genesis Dogo	Agric. Field Attendant I
25.	Mr. Ephesian Clement	Agric. Field Attendant I
26.	Mr. Genesis Miku	Agric. Field Attendant I
27.	Mr. Alim Mohammed	Agric. Field Attendant II

28.	Mr. Manasseh B Andryia	Agric. Field Attendant III

F. <u>WEATHER RECORD</u>: The weather record during the year under review is presented as follows:

<u>Table 5. MEAN TEMPERATURE JANUARY – DECEMBER 2021</u>

	8am mean Temp. (°C)	1pm mean Temp (°C)	4pm mean Temp(°C)
JANUARY	22.40	30.70	27.70
FEBRUARY	20.10	30.70	28.70
MARCH	21.90	30.30	27.20
APRIL	21.70	27.50	23.90
MAY	22.20	26.60	21.70
JUNE	22.50	24.90	22.80
JULY	21.25	24.39	22.82
AUGUST	19.57	23.63	20.96
SEPTEMBER	20.95	25.43	23.36
OCTOBER	24.61	28.24	26.42
NOVEMBER	23.50	27.18	24.10
DECEMBER	20.95	25.43	23.36

<u>Table 6(A) Rainfall figures for January-March 2021</u>

Month	**Rainfall (mm)**	**Rain Days**	**Mean Rainfall (mm)**
January			
February			
March	**229.7**	**7**	**32.8**

<u>Table 6(B) Rainfall figures for April-June 2021</u>

S/N0	**APRIL**	**MAY**	**JUNE**
1	4.4	2.9	-
2	-	-	4.5

3	2.5	-	20.0
4	13.4	18	21.1
5	-	37.1	4.1
6	1.4	-	-
7	10.3	-	2.9
8	-	-	24.5
9	-	-	-
10	16.6	-	-
11	9.2	-	3.7
12	12.2	-	5.6
13	-	34.8	-
14	18.4	10.1	-
15	-	31.05	-
16	12.6	11.2	-
17	60.2	-	3
18	10.8	2.3	-
19	3.6	-	9.2
20	-	-	-
21	14.5	-	20.6
22	2.7	51.8	30.3
23	-	2.8	21.7
24	26.5	-	-
25	-	4	37.1
26	-	34	-
27	1.3	13.8	-
28	-	-	9.4
29	-	20	7.1

30	-	2	6.0
31	-	73.3	-
TOTAL	220.6	349.15	230.8
AVERAGE	12.98	21.83	13.58

Table 6(C) Rainfall figures for July-September 2021

S/N0	JULY	AUGUST	SEPTEMBER
1	5.5	-	26.9
2	44.5	12.3	30.7
3	-	-	-
4	-	-	-
5	48.6	-	86.2
6	15.6	4.6	1.4
7	-	-	-
8	27.2	-	-
9	-	33.7	-
10	-	0.7	-
11	-	5.4	12
12	-	2.2	56.7
13	40	-	39.8
14	4	-	-
15	42.5	46.9	-
16	46.5	4	-
17	-	57.3	20
18	12.4	6.2	-

19	-	20	10
20	11.3	18.6	-
21	63.6	34.7	38.1
22	14	7.5	-
23	-	-	-
24	-	6.6	-
25	-	17.1	-
26	9.2	80	-
27	-	62.8	-
28	-	9.8	69.3
29	-	30.2	-
30	-	15	43.9
31	5.3	-	-
TOTAL	390.2	460.6	435

Table 6(D) Rainfall figures for October-Decxember 2021

S/N0	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	27	-	-
6	-	16	-
7	-	-	-
8	16	-	-
9	-	-	-

10	-	-	-
11	-	21.9	-
12	-	-	-
13	-	-	-
14	-	11.3	-
15	-	-	-
16	-	-	-
17	61	-	-
18	22	-	-
19	-	-	-
20	38.7	-	-
21	-	-	-
22	-	-	-
23	47.2	-	-
24	-	-	-
25	-	-	-
26	10	-	-
27	38.2	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	-	-	-
TOTAL AVERAGE	32.5	16.4	-

G. TRAINING OF COFFEE FARMERS ON MAMBILLA PLATEAU, ORGANISED BY INTEL-APE AND FACILITATED BY CRIN MAMBILLA SUBSTATION

A three-day training was organized by INTEL-APE investors and facilitated by CRIN Mambilla Substation. The training was held from Wednesday, 30th June through Friday 2nd July, 2021, with locations spread as follows:

(i) Wednesday, 30th June, 2021. Venue: Kabri (Lat 6.876^0N; Long 11.419^0E; Alt: 1,636.37m)

(ii) Thursday, 1st July, 2021. Venue: CRIN Subs. (Lat 6.858^0N; Long 11.134^0E; Alt 1,522.18m). The training centred on encouraging the farmers to produce coffee beans that are of best grade so as to ensure acceptance by foreign buyers, who have hitherto abandoned Nigeria's coffee beans. The CRIN HOS at the Mambilla Substation trained the participants on appropriate harvesting procedures; and wet processing of the berries so as to ensure that premium quality and clean coffee beans are supplied to buyers. These training activities were beneficial to the farmers, the researchers and other stakeholders in the entire coffee value chain.

G. <u>BOUNDARIES MAINTENANCE:</u> The station plantation and staff quarters of CRIN have boundaries close to Kusuku residents on all the sides as the station is situated right in the midst of the town. This is a major challenge for the station and its staffers, as the indigent residents of the town have always encroached upon CRIN Land with the intent of outright possession of the land by these locals. Insults, assault and threat to the lives of staff have been recurrent as a consequence.

Land boundary issue of CRIN Mambilla substation, therefore, needs a very urgent attention from the Management. The Institute urgently needs to put up a fencing structure on certain parts of its boundaries at this station so as to mitigate the constant threat to its staffers at the station**.**

In an instance in November 2021, some villagers of Kusuku came out for an outright physical fight the CRIN-staff, including Mr. F.N. (The Head of Plantation in CRIN Mambilla). The station staff, encouraged by the Head of Station (HoS) had to come out to resist the encroachment.

The area where the villagers attempted to encroach this time round was Coffee arabica plot along the major road leading to Kakara town (the location of the Mambilla Beverage (Nigeria) Limited).

The village Head of Kusuku (Jouro Halidu) had to be brought in by the Substation to intervene in the dispute. He expressed his support for the CRIN staff as he attempted to calm tense nerves.

The village Head subsequently advised CRIN to fence its land to avoid encroachment. He further confessed that he was no longer finding it easy having his people under check as they consistently cause trouble to CRIN staff on the land issue. It took some courage and bravery by the staff at the station for CRIN not to have lost any portion of its land, while the boundaries were maintained.

Management also needs to remember that the land dispute at the Mambilla substation seems to be a long-drawn battle, as it predates the current Administration. There is therefore an urgent need for the Headquarters to take practical steps to permanently secure its land at this substation so as to eliminate the encroachment tendencies of these locals, thereby preventing the continuous endangering of the lives of CRIN staff at the Mambilla substation.

YEAR 2021 ANNUAL REPORT OF CRIN IBEKU SUB-STATION UMUAHIA

A. STAFF DISPOSITION:

The staff strength as at December 31, 2021 stood at nineteen (19). This comprises of eight senior staff, that is, the HOS, Station Accountant, three (3) Agric Superintendents, one (1) Secretariat Assistant and two (2) Chief Clerical Officers – one in store and the other in account, and eleven junior staff, that is, two (2) motor mechanic/driver, 1 watchman, 1 other watchman on borrow from the field, 6 field staff in Ibeku and only 1 field staff in Ugbenu Outstation.

Table 1. Staff list of CRIN Ibeku Substation as at 31st December, 2021

S/N	Name	GL	PF	Design.	Date of Birth	Date of 1st Appoint.
1	Dr. Okeniyi Michael O.	13/4	254	HOS/Chief Research Officer	10/12/70	02/01/2002
2	Mrs. U.N. Nmeregini	13/4	281	ACAS	21/10/68	25/09/2002
3	Mr. Borokini Olufisayo	11/4	367	PAS 1	27/03/79	08/02/09
4	Mr. Agbor Charles	8/6	432	PAS II	27/05/78	13/10/2010
5	Mr Ayoade Oluwole P				Deseased	
6	Mrs Nya Emem	7/3	534	HAS	17/12/90	03/03/2021
7	Mr. Onwubiko Michael	7/2	1521	CD	17/08/64	01/06/2003
8	Mr. Onyemuwa J.C.	5/2	1736	SMD/MI	15/05/66	17/03/2010
9	Mr. Eze Joseph	5/3	1680	ACAFO	13/06/67	02/01/2009
10	Mr. Animba Michael	5/3	1686	ACAFO	28/01/65	02/01/2009
11	Mr. Nwachukwu Benedict	3/12	1678	HW	10/06/67	02/01/2009
12	Mrs. Chibuo Oluchi	4/2	1679	AFA I	02/01/70	02/01/2009
13	Mrs. Ihueze Chinedu	3/12	1681	AFA I	15/08/68	02/01/2009
14	Mr. Chimaobi E. I	4/3	1683	AFA I	15/03/68	02/01/2009
15	Mr. Ani Cyril	3/6	1684	AFA I	18/11/63	02/01/2009
16	Mr. Nwachukwu Anthony	4/2	1890	AFA I	12/12/75	14/12/2011

17	Mr, Uwakwe Innocent	2/10	1892	AFA I	14/03/65	14/12/2011
18	Mr. John Muo	1/3	1976	FA	06/11/76	05/03/2021
19	Mr. Uwakwe Christopher	2/2	1976	FA	06/11/76	05/03/2021

Transfer: Three staff were transferred to the station from CRIN headquarters Ibadan

1. Mr. Borokinni Fisayo (PAS)
2. Mr. Azeez Ojelabi (Station Accountant)
3. Mr. Enagu Victor (CAS)

Death: The institute lost a staff in Ibeku substation in the year 2021, Mr. Ayoade Oluwole P. (former station accountant)

B. LAND AREA:

Please find below the landmark of CRIN Ibeku Substation:

Total land area: 80.0 hectares.

Effective hectares: 43.36 hectares

Ugbenu Cashew Experimental Outstation

Total land area: 19.33 hectares

Effective hectares: 11.20 hectares

Total Effective hectares: (43.36 + 11.20) hectares = 54.56 hectares

C. 2021 ACTIVITIES:

FIELD ACTIVITIES: General maintenance of research and commercial plots - slashing, pruning, spraying, pollination, removal of mistletoes, fire tracing, harvesting and processing of pods and ground maintenance of both office blocks at Ibeku and Ugbenu were taken care of.

D. 2021 ACHIEVEMENTS:

1. Internally Generated Revenue: A total sum of Eighty Thousand Naira only (₦80,000) was realized in the year 2021.
Below is the breakdown.

CRIN IBEKU SUBSTATION IGR SUMMARY FOR YEAR 2021

SN	ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
1	Cocoa Beans	-	-	-	-	30000	-	-	-	-	-			30000
2	Cocoa Pods	-	-	-	-	-	-	-	-	-	-			
3	Agbalumo	-	-	-	-	-	-	-	-	-	-	-	-	
4	Ogbono	-	-	-	-	-	-	-	-	-	-	-	-	
5	Plantain	-	-	-	-	-	-	-	-	-	-		-	
6	Banana	-	-	-	-	-	-	-	-	-	-	-	-	
7	Cashew Nut	-	-	-	-	-	50000 -	-	-	-	-	-	-	50000
8	Firewood	-	-	-	-	-	-	-	-	-	-	-	-	
9	Cocoa Seedlings	-	-	-	-	-	-	-	-	-	-	-	-	
10	Palm Fruit	-	-	-	-	-	-	-	-	-	-	-	-	
	TOTAL						**80000**	**-**	**-**	**-**	**-**	**-**		**80000**

3. Peace: We were able to maintain peace in the station and communities.

4. Office and Ground Maintenance: Regular maintenance of the office premises, cutting flowers/lawn thereby maintaining neatness of the office as commended by all visitors of the station in spite of the few labour we have.

5. FIELD ACTIVITIES: General maintenance of research and commercial plots - slashing, pruning, spraying, pollination, removal of mistletoes, fire tracing, harvesting and processing of pods and ground maintenance of both office blocks at Ibeku and Ugbenu were taken care of.

6. Cocoa Seedlings: Seedlings were raised to boost our IGR and for replacing dead cocoa trees in some of our plots.
Also, Cocoa seedlings were raised and distributed to the farmers through Cocoa farmers Association of Nigeria (CFAN) and Cocoa Association of Nigeria (CAN)

E. VISITORS: The following persons visited our office in the course of the year, CFAN and her members, and CAN members.

F. CHALLENGES/CONSTRAINTS:
1. **Lack of portable water:** Both Ibeku substation and Ugbenu experimental station lack portable water

2. Lack of Adequate Work Force: Both Ibeku and Ugbenu lack adequate work force.

3. Chemical Spraying: The substation is in need of fungicides, herbicides and insecticides without which the crop productivity will be grossly reduced. Considering the humid weather at the substation, black pod disease is ravaging the pods coupled with high density of weeds due to shortage of labour and pesticides

4. Overhead: There is high dependency on fuel to keep the substation running effectively. Due to the fact that, out of the 6 substations CRIN Ibeku Substation is the only substation without residential quarters and electricity. The imprest is drastically too small and does not even come on monthly bases.
5. Vehicle Maintenance: The tyres of the station's utility Hilux Project vehicles need replacement. The NCSGP Hilux is currently faulty and needs a total overhauling.

6. Clinic: We urgently need a nurse and health attendants to administer drugs and first aid services in case of emergency like snake bite or accidental cutlass cut injury. There is neither Nurse nor Health attendants in an isolated place like CRIN Ibeku Substation since 2012.

7. Ugbenu Experimental Station: The outstation has only one staff since 2013 and supported by two Project Contract Workers engaged in 2016. No security staff in the outstation. No office in the outstation.

8. Furniture: Lack of good furniture. The station needs tables and chairs for staff.

9. Road: Lack of good road from the station entrance to Admin Block to combat the serious erosion that has taken up CRIN Ibeku office.

10. The carpentry shade is profusely leaking, it needs renovation.

G. ADDITIONAL STAFF REQUEST BY CADRE:

Security	10	(8 in Ibeku and 2 in Ugbenu)
Field Staff	48	(Following the standard set at the headquarters, CRIN Ibeku Substation will require nothing less than 55 field staff to cope with the current 54.56 effective hectares. Therefore, an additional 48 staff at the moment is needed to complement the existing 7 field staff.)
Nurse	1	
Health Attendant	2	
Secretarial Assistant	2	(The only Secretarial Assistant we have will retire this year.)
Clerk	2	
Driver	1	
Total	66	

H. SUGGESTIONS/WAY FORWARD:

1. Imprest: The imprest is drastically too small and doesn't even come monthly. An increase in the imprest will be highly appreciated and receiving it monthly will help us a lot.

2. Furniture: We are in need of furniture in all offices of the station. The furniture we have are mostly bad and obsolete, they have been the ones there since inception of the station.

3. Equipment and Stationery: A brand new laptop and toner based HP printers are needed in the station. The secretarial staff have nothing to work with since the PC in her office is totally bad and beyond repair. For over two years all typing is done in the accountant's office. We are in need of reams of A4 printing papers, toners, staplers and other stationeries for the smooth administrative running of the substation.
4. Bore hole should be dug in the station and Ugbenu to prevent water related disease.

UHONMORA SUBSTATION

Head of Station: Dr. Famuyiwa B. S.

S/N	NAME	DESIGNATION	PHONE NUMBER
1	DR. FAMUYIWA BUSAYO .SOLOMON	HOS	08033978146
2	EDIBO GABRIEL	ACAS	08066545507

3	PHILIP OGUIGO	ACAS	07033181107
4	ASEIN OYAKHIRE	SEO	08036657855
5	OAIHENA LYDIA (MRS)	HEO	07031888644
6	ALABA UMAHOIN	CAFO	08062399335
7	OKPÅISE IDOWU (MRS)	CAFO	07060701641
8	ONOJA JOSEPH	CD/M	07068129566
9	IRUOBE ELIZABETH	CCO	08067179194
10	IFIDON IKHUOSHIO	PHA	07085713536
11	ANIJESE FUNMILAYO (MRS)	CAFO	08065709602
12	DANNIS OJIMAH	ACAFO	08075154789
13	AMEDU ACHONU	ACAFO	08106290329
14	EBALE BENJAMIN	ACAFO	07083647934
15	EDEH SIM0N TOCHUKWU	ACAFO	07032472593
16	NWAGALA CHARLES	ACAFO	08067179166
17	AMAZE AUGUSTINE	ACAFO	08139184020
19	JOSEPH EHIDIAMEN	ACAFO	07037138092
20	KOKORI PAUL	AFA 1	08071310591
21	IMUMOLEN JEFFERY	FAF 1	08134881918
22	OKEDION FRIDAY	AFA 11	08135924292
23	EHIMIKA KETU	AFA 11	09066749259
24	JAMGBADI IMOUDU	AFA 111	09030653041
	Total	23	

Staff List and Disposition: The staff list at the station during the year 2021 is as shown below

Staff Disposition

STAFF	SENIOR STAFF	JUNIOR STAFF	TOTALSTAFF
HOS	1		1
AGRIC SUP	2		2
ACCOUNT	2		2
TRANSPORT	1		1
HEALTH OFFICER	1		1
FIELD		9	12
SECURITY		4	4
TOTAL	10	13	23

Retirement:
Mrs Iruobe Elizabeth retired from the CRIN Service in April, 2021

Land Area:

The Substation was established in 1967and situated along Uhonmora/Ekpoma road, with map coordinates 6.837, 5.962 on 268 ha.

Crops planted

1. Cocoa
2. Cashew
3. Oil palm
4. Plantain

Research Activities:

On-going research experimental plots were maintained in collaboration with the scientists involved. Some of the experiments under the station's supervision include:

1. Establishment of 1.2 hectares of budded and grafted cacao clones in D1 plot, in collaboration with World Cocoa Foundation (WFC) and African Cocoa Initiative (ACI)
2. Establishment of 0.5 hectares of Cocoa germplasm with plantain for distribution to cocoa farmers
3. Establishment of a research plot to determine the appropriate time and height of coppicing in a rehabilitated cacao plantation
4. Establishment of research plot to evaluate the effect of planting pattern of cacao seedlings intercropped with plantain on cacao establishment in the face of prevailing climate change
5. Field evaluation of cocoa pod husk biochar fortified with fertilizer on cocoa yield and soil pshysiochemical properties
6. Field establishment of Tea (*Camellia sinensis*) under varying watering regimes and different plantain shade levels
7. Effect of different geometry cacao intercropping with cocoanut in ideal and marginal cacao environments of Nigeria
8. Pesticides residue assessment across some cacao ecologies in Edo

Structural Development

Renovation of Account Apartment building that was started in 2020.

Achievements:

1. Efforts were made to maintain our plantations with the little resources and available labour.
2. Advocacy visits to Stakeholders

3. Intercrop of cassava into the cashew plantation
4. Improvement of the nursery irrigation system
5. Production of 40,000 cocoa seedlings
6. Purchase of farm inputs
7. Revenue: A total sum of six hundred and fifty eight thousand, two hundred Naira Only (N658,200) was realized from the sales of farm produce and other services.
8. Distribution of Cocoa seedlings to farmers
   The seedlings prepared by CRIN, Uhonmora Sub Station for cocoa farmers were distributed as follows;
   Number of seedlings prepared for distribution = 40,000
   Number of cocoa seedlings ready for distribution = 30,000
   Number of cocoa seedlings distributed to farmers = 16,200
   Number of cocoa seedlings left uncollected = 13,800

Potentials

1. The Substation is at an advantage of land mass if well-funded could have generated more IGR
2. Availability of stable electricity to power investment such as bakery
3. The Guest House can be furnished for use to generate more IGR
4. Establishment of germplasm materials in Cocoa to augment for Headquarters supply to farmers

Challenges/Constraints:

1. There was paucity of fund and this affected the station negatively. Station's overhead which cares for the expenses of the day to day running of the station is not forthcoming and this makes the running of the station difficult.
2. Considering the enormity of the work in our plantation, the present field staff is grossly inadequate to take care of the work.
3. The field officer were not equipped with enough equipment such as cutlasses, files, safety boots and farm wears to work with
4. The Health Centre is moribund short of and health facilities to take care of the staff
5. The present number of security staff is inadequate for effective guarding of the office, staff quarters and plantations.

6. The effect of pandemic Covid 19 and the consequent sit at home by the Federal Government, culminated by the staff strike actually restricted the operation during the year.
7. No drinkable water to service the station
8. Serious fire out break

Suggestions for improvement

1. The overhead should be revived so that it will be regular. This will make it easy for the station to be taking care of her day to day expenses.
2. Provision of working inputs such as herbicides, pesticides, cutlasses, files, safety boots and farm coats
3. Provision of drinkable water either by borehole or well
4. The Substation's guest house needs to be furnished for our researchers that are coming from the headquarters to carry out research work at the substation.
5. Considering the enormity of the work in our plantations, there is a need for more farm workers to complement the few number on ground. The additional staff request by cadre is as follows:

Field Attendant 1 10
Security Guards 4

Or in the alternative the station can be allowed to recruit casual workers.

6. The station can also be allowed to take Internship students and Copers from the National Youth Service

APPENDIX

2021 INTERNALLY GENERATED REVENUE

S/N	ITEM	AMOUNT
1	Land Rent	31,000
2	Cocoa seedlings	220,000
3.	Palm oil	300,000
5	Cocoa Pods	100,500
6	Access fee	6,700
7	Total	**658,200**

LIBRARY, INFORMATION AND DOCUMENTATION DEPARTMENT

LIBRARY DIVISION (Aboderin A.K – Acting Head, Library Division)

The library division is saddled with the responsibility of providing information resources and services to its users through print and electronic formats. In 2021, relevant information resources as it relates to the institute mandate crops were provided to research scientist and other supportive staff. Outsiders such as members of the host community, youth corps members as well as IT students posted to the institute, also benefited from the services rendered during this reported year.

Acquisition: Acquisition of few books and journals were done through purchase and gift. Two newspapers were purchased on a daily basis. Compilation of research work that had been done by CRIN scientists is on-going to check plagiarizing and duplication of same research work. The library division attended to users' query both print and electronic forms. New researchers were also profiled to assert their needed information resources. 1,281 users visited the Library, while 1967 books, 1431 journal titles and 660 newspapers were consulted.

DOCUMENTATION DIVISION (Babafemi, Ibitope B. – Asst. Chief Program Analyst)

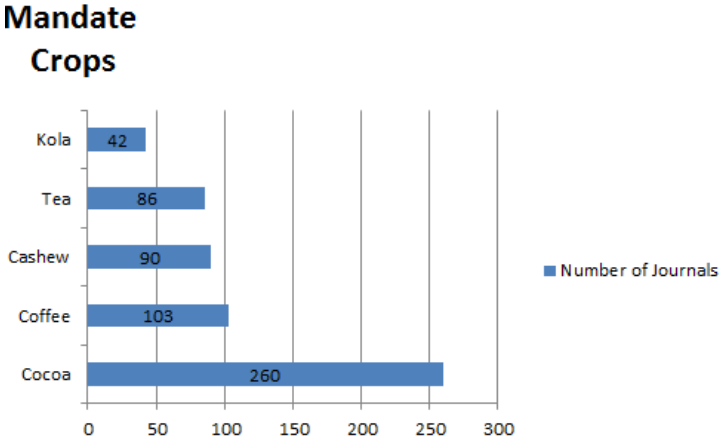
The Documentation Division is comprised of three (3) sections: Library Automation System, CRIN ID Card Production and Annual Report Compilation.

1. **Library Automation Systems**

Activities and Achievement

In the year 2021, a total number of 581 CRIN mandate crops (Cocoa, Coffee, Cashew, Kola and Tea) research journals were downloaded via the internet. This aimed at making up-to-date relevant CRIN mandate crops available to scientists in a digitalized format for their research works.

Below is the breakdown of the downloaded research journals:



2. **CRIN ID Card Production**

Activities and Achievement

- New customized CRIN Staff Identity cards were used for ID card printing
- 232 Staff Identity cards were collated, designed and printed on request as approved
- In-house training was conducted to the ad-hoc staff that are in charge of the ID card production

3. **Annual Reports Compilation**

Activities and Achievement

In the year 2021, Annual Reports of various Departments were compiled and formatted for printing.

ICT DIVISION

INTERNET

The Institute is connected to the Internet through Globacom fibre link which was terminated in the server room. The bandwidth of connectivity was 4Mbps but it was graciously upgraded to 100Mbps by the Executive Director, Dr. Patrick Adebola on November 6, 2021. There is a point-to-point wireless connection from SPN, LID and ERLS Departments to the fibre link. With the exception of Account Department and office of some Directors, all staff in the Institute are connected wirelessly to the Internet. The Engineering Department as well as PEM are not connected to the Internet at the moment. However, plans are on going to connect these locations as well as the event centre, the multi-purpose hall and the ultramodern labouratory presently under construction to Inernet through direct fibre link to the buildings.

The Internet link has been grossly hampered by power failures both in the server room and the ERLS as well as SPN Departments; the Inverter located at these locations has suffered defects. The Internet equipment at ERLS was grounded by the inability of the Department to reconnect the equipment to the newly deployed inverter after the old inverter suffered defect.

In-House Training on Internet Network Management

The training commenced on December 15, 2021 and ended on the 23rd day of December, 2021. The facilitator was Mr. Felix Fapohunda, the CEO of ROUTEL Solutions and Consults Limited. The training was geared towards arming the staff of the Information and Communication Technology (ICT) Division with the practical exposures needed to properly manage the100Mbps bandwidth from Globacom. The training was hands on and was centered on the existing network infrastructure and future expansion. The following staff were trained:

1	Ibe Osita	Ag. Head, ICT Division
2	Ibitope Babafemi	Assistant Chief Programme Analyst
3	Tunji Adeyemo	Library Officer
4	Gbenga Oyeditun	Chief Printer

The Course deliverables

The trainee were trained on the following areas of network management that related to the core equipment used in the Institute:

1 Introduction to networking
2 IP addressing and subnetting
3 Basic configuration for Internet setup on Mikrotik
4 IP addressing
5 Bridging
6 Firewall and NAT
7 DNS
8 Wireless configuration
9 Bandwidth management and QoS
10 Hotspot, Radius and user manager configuration

11 Basic Network Troubleshooting

Current Network Structure and Expansion

There are currently 9 pcs of indoor radio and one outdoor radio for wireless network access in the Institute. The table below gives the breakdown of the distribution:

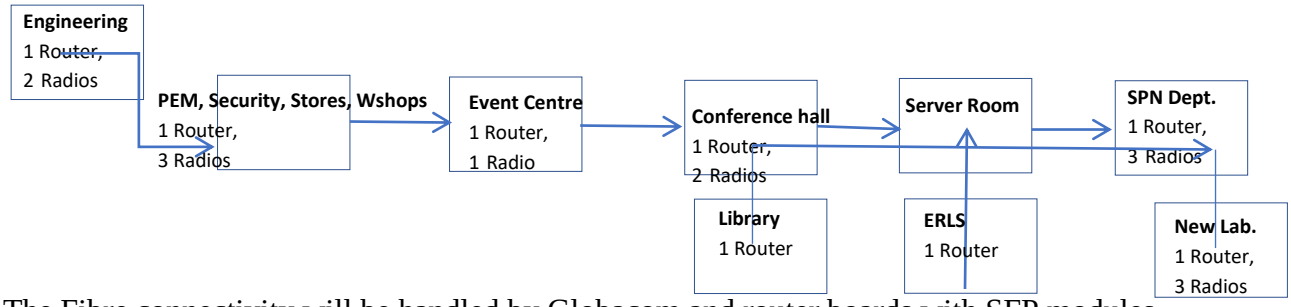
Table 1: Available and outstanding radio distributions

S/N	Location	Radio	
		Available	Outstanding
1	Directorate	1	2
2	Account	1	1
3	Conference hall	1	-
4	FSR	1	2
5	Plant breeding	1	3
6	ERLS	2	1
7	LID	1	2
8	SPN	2	-
Total outstanding radios			11

As shown from the table, a total of 11 radios would be required to the reach of the current network structure.

Network Extension and Enhancement

At the moment, Engineering, Plantation Management (PEM), event centre, multipurpose hall and the ultramodern lab is yet to be connected to the network. The Library, Information and Documentation (LID) Department, Economics and Extension as well as the Soil and Plant Nutrition (SPN) Department are bound to suffer signal loss and network failure with time owing to the location with respect to the central Access point and Line-Of-Sight connectivity. This can be facilitated by extending the fibre link directly to these locations. The links will be terminated in the Internet Server Room for proper network management. Below is the schematic diagram of the proposed fibre connectivity.



The Fibre connectivity will be handled by Globacom and router boards with SFP modules, switches, radios and racks will be required at each node, with the exception of ERLS. On the whole, 8 routers, 14 radios and 7 racks that would be needed for the network expansion. Additionally, a Cloud Core Router is needed in the Internet server room for proper management of the 100Mbps bandwidth. Table 2 shows the breakdown of the fibre link requirements.

Table 1: Fibre link requirements

S/N	Description
1	Excavation, laying and backfilling (Normal soil, 1.2m depth)
2	Concrete breaking
3	Thrustboring
4	MH construction
5	Supply of 12 Fibre cable
6	Supply of 1-way duct
7	Supply of 12 port patch panel
8	Patch cord
9	Termination of fibre cable

WEBSITE

The Institute website domain is www.crin.gov.ng. This is the platform for the global visibility of the Institute. The website was originally designed in-house but a contract for a redesign was awarded to The MAXMACT Technologies solution and the site was uploaded in October 22, 2021. Figure 1 is the schematic diagram of the new website