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Evaluation of Domestication and Commercialization of Non-timber Forest Products:

A Case Study of *Thaumatococcus daniellii* (Benth) Leaves in Three Forest Land Systems

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Abstract

Deforestation and land devegetation for other development purposes have destroyed lots of habitants of many individual renewable natural resources or non-timber forest products (NTFP) including that of Thaumatococcus daniellii. This has now made the production of leaves of this food – items wrapping plant species among the Yoruba speaking of the southwestern part of Nigeria, a dwindling venture. The commodity becomes scarce and comparatively more expensive than it used to be in the market as farmers have not been shown the possibility of its large-scale cultivation. Its market potentials have not been considered very important and lucrative. This study attempted to evaluate this plant's regenerating and marketing potentials as well as it's lucratively as a readily available source of cash income to the poor resources famers/NTFPs collector. It has been observed that Thaumatococcus daniellii could be successfully regenerated/ domesticated under natural or secondary forest land-use systems. Growth parameters and average land areas covered by the plants in two years were observed to be the highest under domestication site. Regenerating characteristics of the plant indicates an estimated leaf production of 54,889 numbers per hectare in 2 years or 27,444 leaves per hectare per annum. Market survey of volume of trade in the leaf of T. daniellii in Mamu, Oja-oba, Onidundun, Aleshinloye, Aba-Nla and Dugbe markets around Ibadan and its environs indicated an average volume of ₦100,000.00 (one hundred thousand naira) per season or US $666.67 per season.

Key words: *Thaumatococcus danielli leaves, NTFPs, three forest land-use systems, Regeneration, Domestication, commercialization and Market evaluations*

Introduction

The use of leaves from the forests as wrapping materials for various items, including prepared food, processed nuts, fruits and vegetables by the indigenous people, has been recognized from time immemorial.

Various broad leaves are found in use for these purposes, however the leaves of *Thaumatococcus daniellii* is more common in use among the Yoruba race of rainforest ecological zone (Dalziel, 1937). The leaf is substantially valued for its usefulness as wrappers for prepared food items particularly in cool or hot conditions. The special aroma the leaves impart to its wrapped food items (wrapped-up-hot-pap) which when cooled become palatable, is particularly of interest to an average Yoruba man. Its use in wrapping other starchy staple food items prepared from cassava, yam, cereal and beans (eba, fufu, amala, rice, moinmoin (bean porridge), provides an insulating effect that lengthens the packaging temperature to enhance increase in shelf-live/storability of the products. The use of these leaves for this purpose is well recognized in all the rural and urban centers of the countries along the West and Central African sub-regions (Abbiw, 1990).

Thaumatococcus daniellii, a member of the family *Thaila, Linn*. is an undergrowth plant in cool but dry environment. The plant occurs wild. It has a simple, very large, caudate leaf (25 x 30cm) borne on a petiole of 2m to 4m long. The main stem is a rhizome, which is subterranean. Its fruit which contain thaumatin (a sweetening agent) is also a subterranean; fruits are produced and borne along the rhizome underground. (Abbiw, 1990). It is commonly found either in natural forest or in secondary forest where recent forest clearing has taken place (Dalziel, 1937) as one of the primary colonizer.

In this study, the sites were designated as follows:

NF = Natural Forest (sample plot sited in Gambari Forest Reserve)

SF = Secondary Forest (sample plot sited at Onidundun village in Akinyele local Government area, via Ibadan).

DS = Domestication Site (CENRAD Headquarters' Field Ibadan).

The areas where the sampled plots were sited have the basis of minimizing the differences in micro-climate, botanical composition and soil conditions. However, the soil type is Egbeda series, sites were in close proximity (23-26 km to CENRAD site). All together, the three sites have experienced greater biotic disturbance, yet the plots have a general reflection of the condition of forest area.

For the market survey, Mamu, Oja-oba, Onidundun, Aleshinloye, Aba-Nla and Dugbe markets were selected for Rapid Appraisal Survey (RAS) which usually take place twice in a year; late dry season and at the peak of the rainy seasons for the period of study.

Domestication of these plant species should be encouraged. They have high production potential of leaves for wrapping other food items. The bulk waste after use constitutes a major dust-bin manageable solid waste which can go into the production of organic fertilizer.

Research should be intensified for Conservation and domestication of this species and other known plants. Farmers should be taught to propagate the leaves and have plantation of them. They should be also be taught on how to manage and harvest their plantations on a sustainable basis, efforts should be extended to the areas of research and development of *Thaumatococcus daniellii* and other various known plants, including their propagation and sustainable harvests .

T. daniellii is one of the valuable NTFPs that have not been accorded priority research both in its regenerating and commercialization/trade studies. This paper, thus reports efforts recently made in these directions within the range of its habitat.

Materials and Methods

a) Sites and markets selection procedures:

Research selection criteria were logically in response to situation of general ecological map within the large rainforest environment of the habitat of *T. daniellii* in the southwest of the Yoruba speaking communities, particularly in Ibadan and its environs. In the Southwest of Nigeria, because of the forest area, sampling problems were eased. Since the study attempted to document change over time, sample of similar forest sites were selected to observe growth and spread per season of *T. daniellii* under natural forest, secondary forest (in cocoa-plantation) and at domestication (CENRAD Headquarter) sites, under different land-use systems at the same period. For it is not uncommon to find *T. daniellii* in secondary forest which has been cropped with cocoa (*Theobroma cacao*) or Cola (*Cola nitida*).

The plant is now highly threatened because of deforestation processes which have tremendously shrunk its habitat-spread. Harvesters now have to trek several kilometers from their villages inside the forests before ample commercial quantity or weight could be harvested. Often at times, harvesting from cocoa plantations is made to complement those collected from the forests to make up the marketable load.

Use of polythene sheets

It is believed in some quarters that the dwindling trend in the availability of these leaves and other alternative wrapping leaf species has made people to reject the use of these leaves for the use of polythene sheets for wrapping food items rather than civilization.

The uses of polythene sheets as wrapper are now causing hardship in the management of solid waste by-products in the urban and peri-urban environment of most developing countries (Ladipo *et al*, 1997). This is because of their non - bio gradable characteristics. Means of converting or recycling these various brands and types of poly-products are lacking. Unlike in the advanced countries where various technologies of recycling polythene sheets/rubber containers for re-use are common.

Thinking alone about this environmental inconveniencies, most especially in the area of solid waste management, the use of wrapping materials from shrubs and tree species needs be revived as they are bio gradable, and renewable resources which with small but intensified efforts could bring them back to their old glory (a good component of biodegradable material).

b) Establishment of sample plots

Ten rhizomes of *T. daniellii* were planted in each study sites in triplicate with 5 meters in between. Sixty rhizomes of equal height (5cm), were collected from Gambari Forest Reserve and thirty were planted each at CENRAD and Onidundun village while ten rhizomes in three places of 5cm high were isolated at the point of collection at Gambari Forest Reserve.

In each site, the thirty rhizomes were planted to cover three square meters at 10 rhizomes per square meter in triplicate at each site.

Sites:

NF – plot of one square meter each containing ten rhizomes was established in triplicate.
SF – plots of one square meter in dimension in three places were marked out in cocoa plantation with full knowledge and active participation of the farmers, ensuring the plot was not tampered with.
DS – plots were established underneath an old mango three with crown diameter of 20m, with other established forest fruit trees, mimicking a forest environment.

Plots were all established at the peak of the rainy season (June, 1997) while the first assessment took place at the peak of dry season (January 1998). The leaves were not harvested throughout the period of study.

All the three sites were assessed at seasonal interval having fully established.

C) Data collection procedure

The study covered the period 1998-2000. During this period data collected include:

i) Growth parameters
ii) Limited spread over land area.
iii) Seasonal prices of the leaves at three market niches (Rural peri-urban and urban)

Growth parameters assessed include stem length, width of leaf and leaf blade length. Increase in number of stems per area per season were used to determine rate of spread over land, while average prices in the markets were used to assess seasonal value of commercialization of the leaves.

Results and Discussions

The data collected and analysis of variance of various parameters evaluated are as shown in Tables 1 and 2. The results have statistically indicated a non-significance difference within the three sites, however, the picture generated from the graphs clearly indicated the difference in growth and land area covered during the period of study.

Table 1: Mean growth parameters evaluated under three forest land–use systems (1999 - 2000)

Sites	Average leaf. Length (cm)	Average Leaf. Width (cm)	Average stem Height (cm)	Average Number. of leaves	Average. Total land area covered (m^2)
NF	24.5	20	32.75	910	8.04
DS	35.5	24	67.75	1125	8.84
SF	22.5	18.25	26	713	5.04

NF = Natural Forest (sample plot sited in Gambari F/R)
SF = Secondary Forest (sample plot sited at Onidundun village in Akinyele local Government area, via Ibadan).
DS = Domestication Site (CENRAD Headquarters' Field Ibadan).

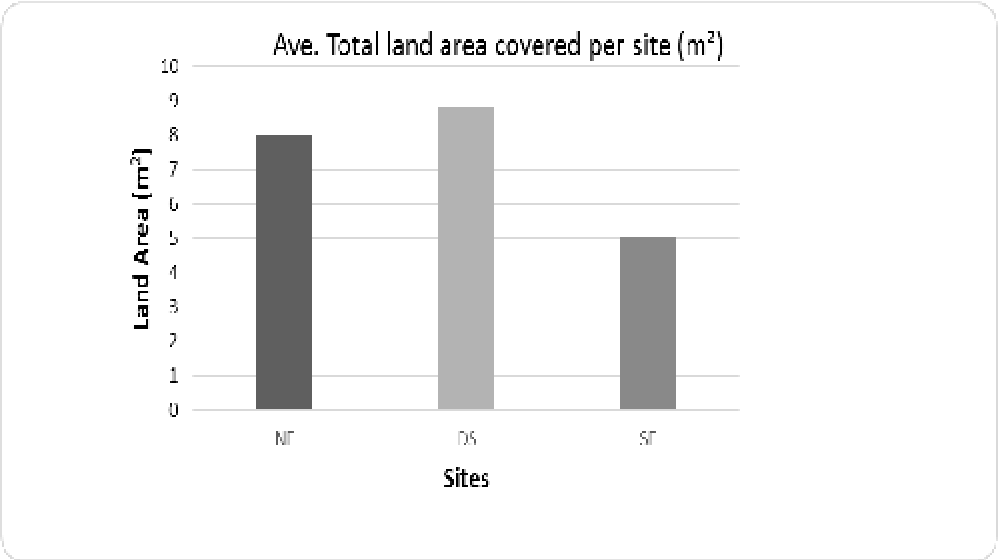
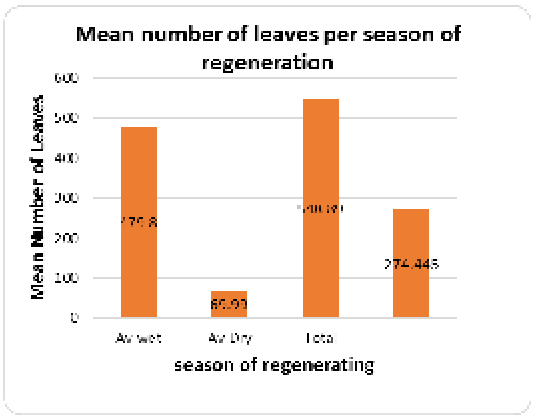
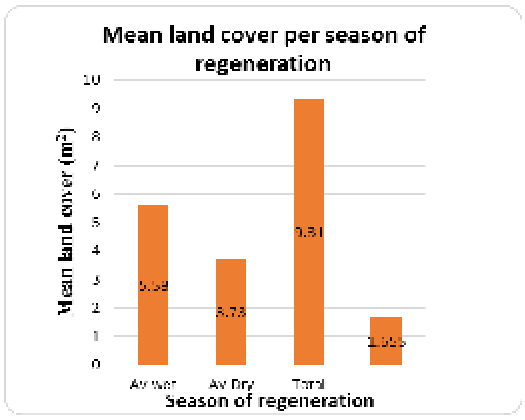


Table 2: Characteristics of regenerating *Thaumtococcus daniellii* leaves in various forest land-use system (1999 - 2000)

		Season of regenerating			
		Av-wet	Av-Dry	Total	
Characteristics	1999	1999-2000	1999-2000	Mean	Mean
Mean Length of Lvs(cm)		32	22.83	54.83	27.45
Mean width of Lvs (cm)		13	15.5	28.5	14.25
Mean Height of stem		48.9	35.33	84.23	42.115
Mean No of Lvs		479.8	69.99	548.89	274.445
Mean Land covered m^2		5.58	3.73	9.31	1.655

Estimated total No Leaves/100m^2 ha^{-1} = 54889.00 in 2 years.
27444.00 in 1 year.





a) Growth parameters

Table 1, indicates the mean growth parameters evaluated which included; average leaf length, leaf width, stem height and number of leaves. The average total land areas covered were also evaluated in each site. The differences in performance of assessed parameters were clearly observed using the emerging graphs. Performances under treatment DS (Domestication Site) were the best, and those NF (Natural Forest) were better than those of SF (Secondary Forest). Though the differences in each site growth parameters when compared were not statistically significant yet with the fingers, the over-all impression was that the three sites favored the production of *T. daniellii* leaves. This is an indication of the possibility of regenerating the leaves under domestication process. At the DS, the number of leaves produced and area covered which, were better than those of NF and SF, lend credence to this observation.

b) Characteristics of regenerating the species

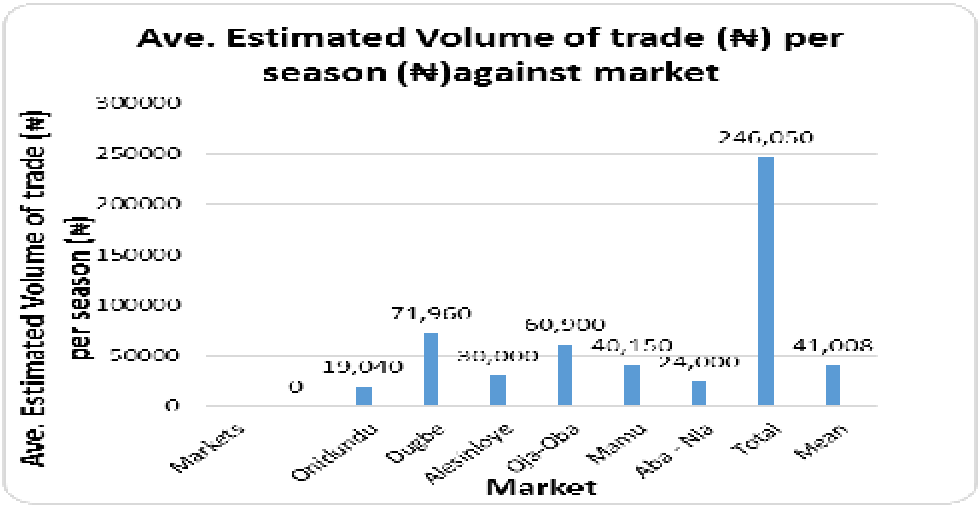
Table 2 shows clearly the regenerating characteristics of *T. daniellii* which measured the number and leaves quality in terms of texture produced per hectare in wet and dry season. As it is with any plant in its natural or similar simulated habitat, tendency is to grow at faster rate to accumulate biomass in the wet seasons *T. daniellii* is not an exception. The difference in mean numbers of leaves and mean rate of spread in the wet season (479.8 over 5.58m^2) are highly significant compared with those of dry season (66.99 over 3.73m^2). This indicates that moisture could be a limiting factor to the fast rate of regenerating *T. daniellii* even under its natural habitat. This also indicates that the species could be amendable to domestication for commercialization. It is also estimated that 27,444 leaves per hectare can be harvested or culled out in a year without having any adverse effect on spread and rate of the cultivated land mass.

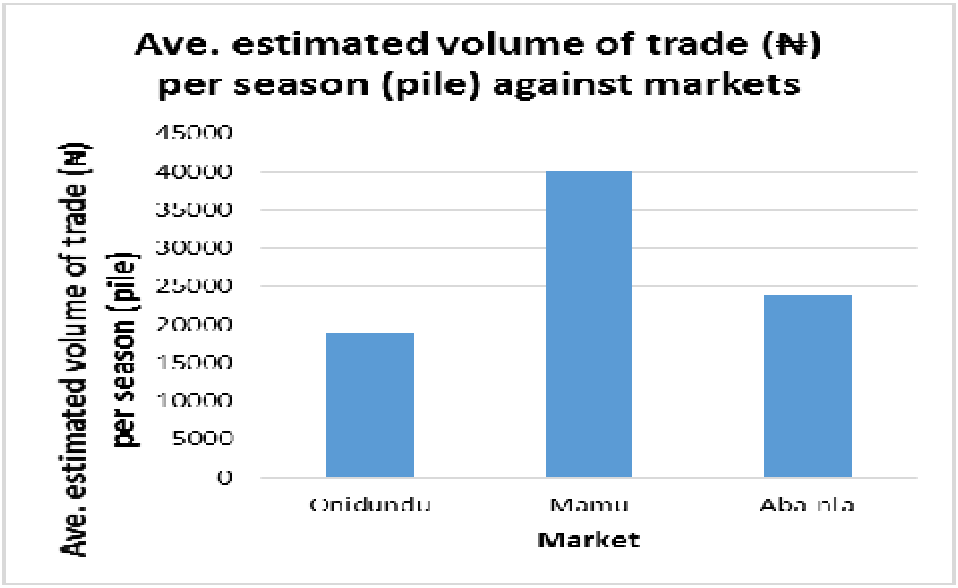
c) Market Survey

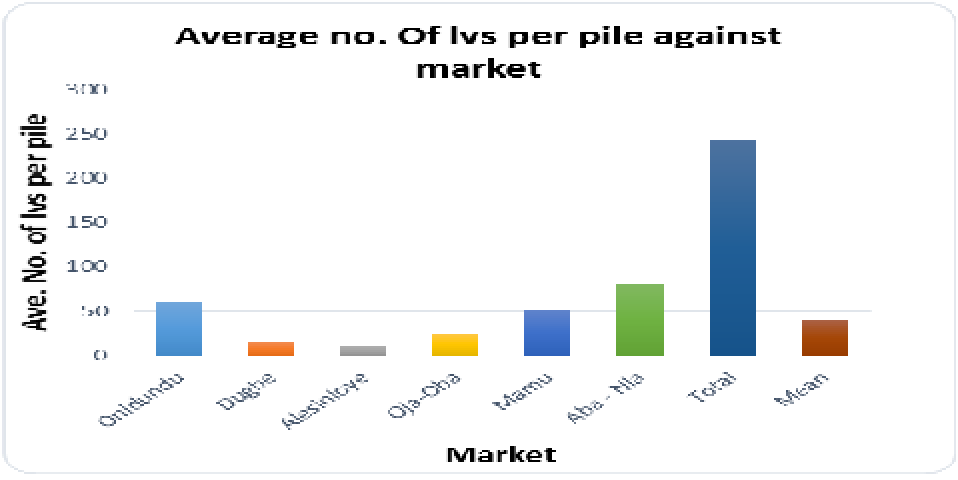
Tables 3-5 and their accompanied graphs show various observations in the trade and marketing potentials of *T. daniellii* leaves at six markets can be categorized into two market niches; rural and urban. It was after these evaluations that each market niche was evaluated as shown in Table 4 and 5, in order to be able to determine the volume of commercialization and revenue per season.

Table 3: Market survey (price and volume) of *T. daniellii* leaves at various market niches (1999-2000)

Markets	Location	Proximity to Ibadan	Niche	Average No. of Leaves per pile	Average price per Pile	Average Estimated Volume of trade (₦) per season	
						Pile	₦
Onidundu	Akinyele L.G.A	25	Rural	60.5	95.2	200	19,040
Dugbe	Ibadan NW. L.G.A.	0	Urban	15.3	25.7	2800	71,960
Alesinloye	Ibadan NW. L.G.A.	0	Urban	11.2	20	1500	30,000
Oja-Oba	Ibadan Municipal	0	Urban	25	20.3	3000	60,900
Mamu	North L.G.A. Ogun	23	Rural	50.7	80.3	500	40,150
Aba - Nla	Oluyole L.G.A.	10	Rural	80.9	80	300	24,000
Total				**243.6**	**321.5**	**8300**	**246,050**
Mean				**40.6**	**53.58**	**1383.33**	**41,008**


Ave. Estimated Volume of trade (₦) per season (₦)against market
Ave. Estimated Volume of trade (₦) per season (₦)
300000
250000
200000
150000
100000
50000
0
0
19,040
71,960
30,000
60,900
40,150
24,000
246,050
41,008
Markets
Onidundu
Dugbe
Alesinloye
Oja-Oba
Mamu
Aba - Nla
Total
Mean
Market


Ave. estimated volume of trade (₦) per season (pile) against markets
Ave. estimated volume of trade (₦) per season (pile)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Onidundu
Mamu
Aba nla
Market


Average no. Of lvs per pile against market
Ave. No. of lvs per pile
300
250
200
150
100
50
0
Onidundu
Dugbe
Alesinloye
Oja-Oba
Mamu
Aba - Nla
Total
Mean
Market

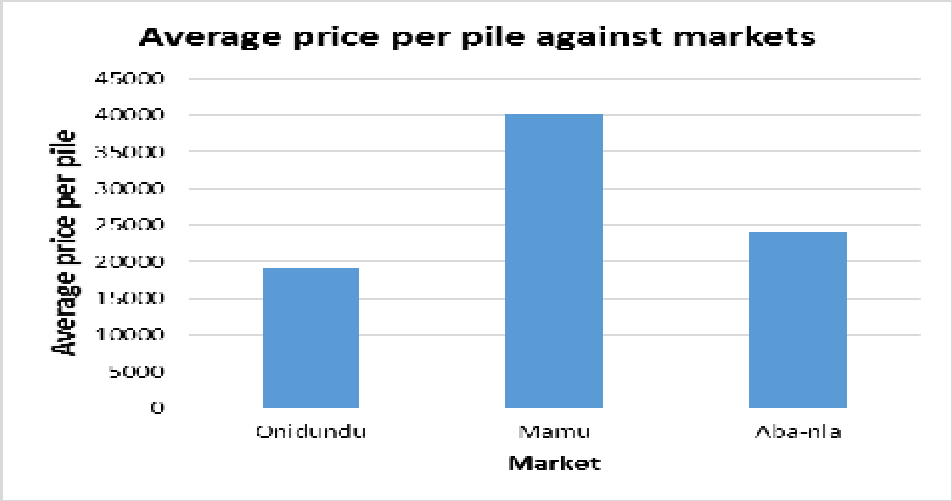
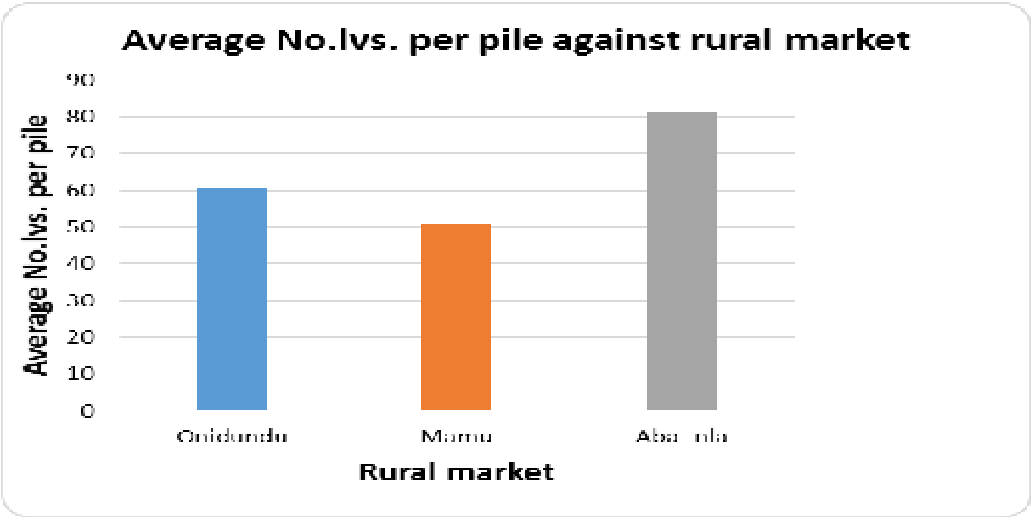
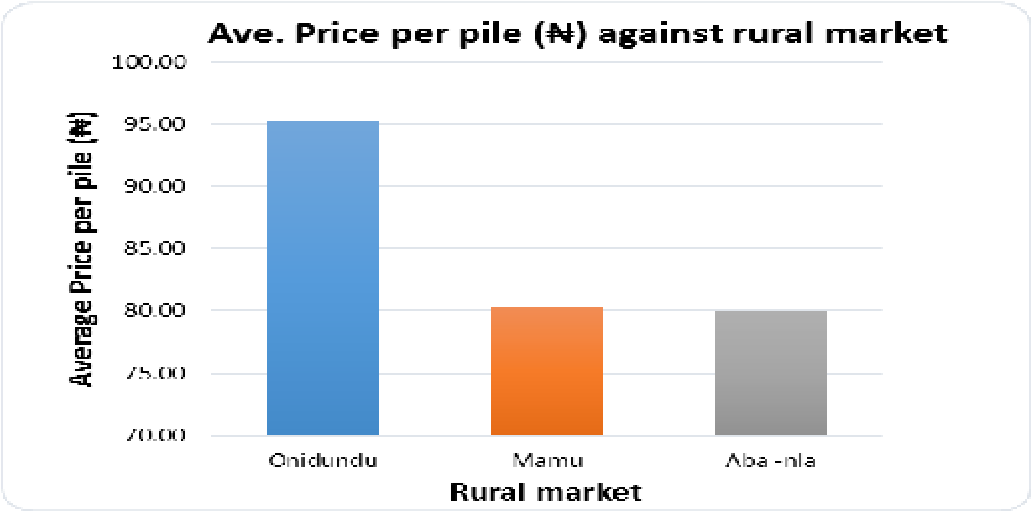
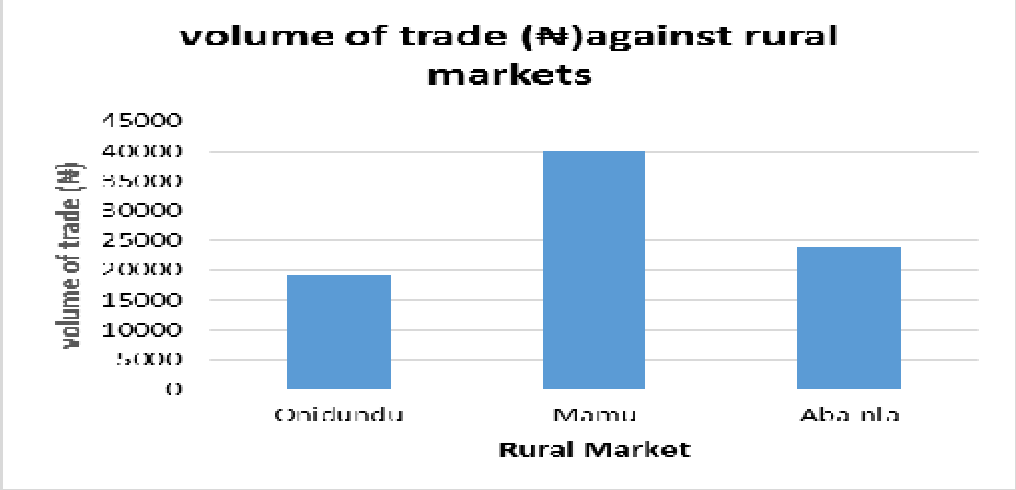


Table 4: Mean Average of Parameters assessed of the Market survey in Rural Markets

Markets		Location	Proximity to Ibadan	Nich	Average No. lvs. per pile	Average Price per pile (₦)	Ave. Estimated Volume of trade (₦) per season Piles	(₦)
Onidundu	1	Akinyele L. G. A	25	Rural	60.5	95.20	200	19040.00
Mamu	2	Ijebu North L. G. A. Ogun State	23	Rural	50.7	80.30	500	40150.00
Aba -nla	3	Oluyole	10	Rural	80.9	80.00	300	24000.00
Total					**192.1**	**255.50**	**1000**	**83190.00**




Ave. Price per pile (₦) against rural market
Average Price per pile (₦)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
Onidundu
Mamu
Aba -nla
Rural market


volume of trade (₦)against rural markets
volume of trade (₦)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Onidundu
Mamu
Aba nla
Rural Market

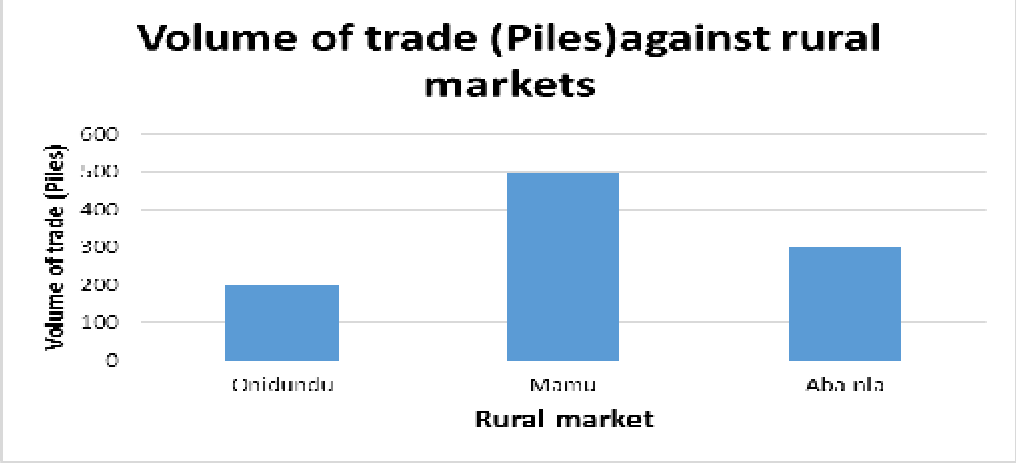
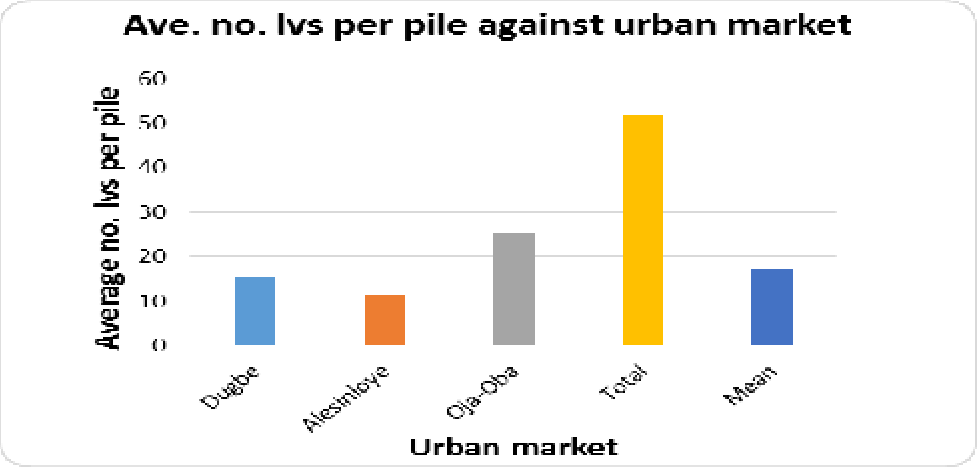
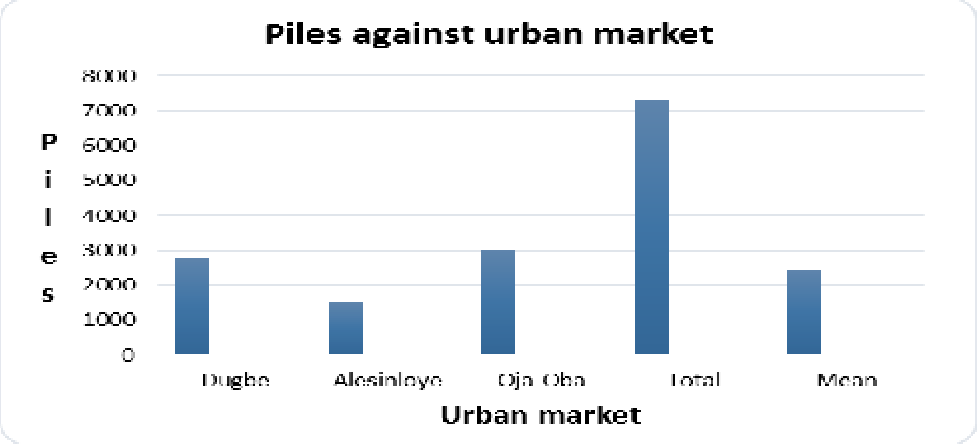

Volume of trade (Piles)against rural markets
Volume of trade (Piles)
600
500
400
300
200
100
0
Onidundu
Mamu
Aba nla
Rural market

Table 5: Mean Average of Market Survey Parameters in Urban Markets

Markets	Location		Proximity to Ibadan	Nich	Average No. Ivs. Per pile	Average price Per pile	Average Estimated Volume of trade (₦) per season Piles	(₦)
Dugbe	Ibadan NW. L.G.A		0	Urban	15.3	25.7	2800	71,960
Alesinloye	Ibadan NW. L.G.A		0	Urban	11.2	20	1500	30,000
Oja-Oba	Ibadan Municipal		0	Urban	25	20.3	3000	60,900
Total					**51.5**	**66**	**7300**	**162,860**
Mean					**17.17**	**22**	**2433.33**	**30,323.98**





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