



## **Analysis of Timber Marketing in Lokoja Metropolis, Kogi State, Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Inadequate marketing information about timber species, their sources, market structure and performance has greatly hampered the effectiveness of the business and has hindered investment in the forestry sector. The dearth of market information on market performance and activities have hindered investments in to forest industry and limited its capacity to contribute to economic growth and development of the country. This study therefore analysed timber marketing in Lokoja Metropolis, Kogi State, Nigeria. A semi-structured questionnaire was administered to collect relevant information. Purposive and systematic sampling were applied to determine the study sample which was drawn from three timber markets; Ganaja, Felele and Zango daji. Applying 30% sampling intensity except in markets where the traders were less than ten, 40 timber traders were systematically sampled and interviewed on timber marketing activities. The study identified seven (7) most marketed timber species namely: *Daniellia oliveri*, *Gmelina arborea*, *Milicia excelsa*, *Ficus exasperata*, *Prosopis africana*, *Triplochiton scleroxylon* and *Khaya grandifoliola*. The major source of timber was from the open forest (92.5%), while supply within the state (27.5%) accounted as the highest, followed by Abuja (20%). The Gini-correlation co-efficient analysis for the study was 0.1552, and this implies that the timber market is imperfectly competitive with the market structure tending towards monopoly. Timber income analysis per truck of the seven species revealed that *Daniellia oliveri* recorded the highest mean return of 517, 005.99 per month while *Ficus exasperata* had the least mean monthly gross margin of 35,336.56. The mean gross margin of *Khaya grandifoliola*, *Milicia excelsa*, *Prosopis africana*, *Gmelina arborea* and *Triplochiton scleroxylon* had the same mean

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returns of 466,270 per month. Low patronage, scarcity of demanded wood species, lack of supply of wood species and high tax were identified as the major challenges facing timber market in the study area. Provision of adequate market education, proper examination and checking of excess associations will improve market efficiency and performance. Therefore, investment into forest development should be encouraged to ensure sustainable supply of raw materials for an efficient market system.

*Keywords: Marketed timber species; Gini correlation coefficient analysis; profitability; marketing activities.*

## 1. INTRODUCTION

Forests serve as an engine of growth that provides economic activities and have created positive impacts on the economy in Nigeria not only foreign exchange earnings but also in socio economic development [1]. According to Sambe [2] sawn timber is one of the most important products from the forest that is used for various purposes and is fundamental for the socio-economic development of Nigeria. It is processed into many various dimensions for efficient and multiple end uses and the product is produced for both domestic and imported round wood either by sawing lengthwise or by a profile chipping process. Sawn wood has the highest production demand and can be applied in multiple uses as raw material for the production of furniture, furniture components and other secondary wood products [3].

In Nigeria, local sawn timber marketing activities constitutes a reliable source of livelihood sustainability through cash income and employment in many rural and urban areas. These activities include loading, offloading, transportation, processing among others [4,5]. According to Fuwape, and Ofoegbu, [6,7], the timber industry has contributed significantly to the socio-economic development of Nigeria and ranks among the highest revenue and employment generating sectors and a major contributor to the national domestic product (gross domestic product - GDP). According to Badejo, [8] timber sector is capable of inducing investment in other branches of production because of its heterogeneous nature and versatile uses which encourage new industrial activities in any economy.

The timber sector has however been experiencing a gradual set back in recent times largely because of overexploitation, decline timber species availability and partly because of the industry is still largely oriented towards exporting raw materials [9,10,11].

Sustainably managed forests can contribute to poverty alleviation, the protection of environment service and sustainable economic growth in developing and transition countries [12]. This fact can have high rate of multiplier effect on capacity utilization, employment generation and foreign exchange earnings.

Marketing provides a set of tools which people can use to create efficient economic value for its resources and products [13,14]. However, research has shown that timber market is characterised by inadequate information on marketed species, supply sources and competition nature which has compromised the ability of the sector to contribute optimally to employment and development. The requirement for efficient marketing operations such as knowledge on species supply and distribution, performance, competition, conduct and organisation directly affects the efficiency of timber marketing [15]. This presents problems for investment and development of the resource base and the market system. Therefore, adequate information can improve the forestry development and management. These benefits could be sustained through effective management, conservation, adequate distribution and allocation. Hence, this study seeks to identify timber species marketed, determine the profitability and assess the structure and performance of timber market in Lokoja metropolis of Kogi State.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Lokoja lies at the confluence of Niger and Benue rivers and is the capital of Kogi State, Nigeria. It is bounded by the Niger river in the north and east upstream from the capital until the border with Kwara State. It is located at latitude 7° 48' 59.99" N and longitude 6° 44' 59.99" E. The climate of the area is tropical savannah climate or tropical wet or dry climate. Lokoja has an area

of 3,186 km<sup>2</sup> with an estimated population of 596,526 [16]. The local vegetation falls within the guinea savanna belt of Nigeria. Some common timber species found in the area includes Iroko (*Melicia excelsa*), Mahogany (*Khaya grandifoliola*), Obeche (*Triplochiton scleroxylon*), Gmelina (*Gmelina arborea*), and Iron wood (*Prosopis africana*). Timber activity is carried out in three locations in the study area namely, Felele, Ganaja and Zango daji which forms the three timber markets in the area. Zango daji timber market was the first timber market to be demarcated and allocated by the State government for timber activities, which later gave birth to two other timber markets namely Felele timber market and Ganaja timber market. The major occupation of the people in the study area is farming. Although other enterprise such as the timber enterprise is thriving in the area.

## 2.2 Study Population and Sampling Techniques

The study population comprises of timber traders in the study area and their activities. The study adopted a survey research design. It is useful in gathering authentic data sets in a systematic investigation to understand and analyze new trend, market demands and opinions. The study was carried out in three (3) timber markets purposively selected (Ganaja, Felele, and Zango daji) based on timber market activities. In each of the three markets 30% of sampling intensity was applied to select the study sample, except in markets where the number of marketers is less than 10. Ten (10) samples were collected from the Ganaja and Felele timber market, and 20 samples were collected from Zango daji timber market. Hence, a total of 40 samples were collected by administered questionnaires.

## 2.3 Data Collection

Data was collected from primary and secondary sources. The primary sources included questionnaire, personal observation and enquires while secondary included literatures from published and unpublished works. A semi structured questionnaire was designed and was administered on timber traders. The questionnaire comprised parts; A and B. Part A contained socio-economic data while B contained questions on marketing information such as performance, species traded, sales income and challenges of timber trading in the study area. The semi structured questionnaires

designed for the marketers was validated through a pre-test on a cross section of respondents in Lokoja. Information obtained was utilized in restructuring these sets of questionnaires to eliminate both ambiguities and biases in measurements. Missing information were also included. These was re-tested and confirmed satisfactory.

## 2.4 Data Analysis

The data collected was analysed using descriptive statistics, Gini-correlation coefficient and Gross margin analysis by SPSS version 17 Software. Descriptive statistics such as frequency, percentages and tables were used to identify timber species and their sources and challenges in the study area, while Gross margin analysis was applied for determine the income from the enterprise. Gini- correlation coefficient was used the market structure and performance in the study area.

## 2.5 Gross Margin

Gross margin is defined as the difference between Gross Income (GI) and Total Variable costs (TVC). According to Tee et al.,[17], the model is as follows:

$$GM = GI - TVC \quad (\text{Equation 1})$$

Where: GM = Gross Margin, GI = Gross Income, an equivalent of Total revenue, TVC = Total Variable Costs (Transportation, Tariffs, Association levies, permits, tax, loading/offloading etc.).

## 2.6 Gini-correlation Coefficient

Gini- coefficient was used to examine the market concentration of timber traders which involves the measurement of the level of sellers' concentration in the market in order to determine the degree of competition or monopoly in the market. As used by Billa and Bullama [18], the formula is given as:

$$G = 1 - \sum XY \quad (\text{Equation 2})$$

Where: G= Gini-Coefficient, X= percentage of sellers, Y= Cumulative percentage of sales. When G= 0, there is perfect equality in the size of the distribution of the sellers, however when G= (1), there is perfect monopoly in the market.

### 3. RESULTS AND DISCUSSION

#### 3.1 Socio Economic Characteristics of Respondent in the Study Area

The result showed in Table 1 reveals that majority (40%) of timber marketers were between 41-50 years. In terms of sex, 75.5% of the respondents were male while 25% were female. For marital status, 77.5% were married while 22.5% were single. The data further shows that 17.5% had primary school education, 65.0% had secondary school education while 16.5% had tertiary education. Based on experience, majority

of the respondents (72.5) has had 10 years and above experience.

#### 3.2 Timber Species Most Marketed and their Sources in the Study Area

##### 3.2.1 Most marketed species in the study area

Seven marketed timber species were identified in the study area. They are *Prosopis africana*, *Gmelina arborea*, *Khaya grandifoliola*, *Daniellia oliveri*, *Milicia excelsa*, *Triplochiton scleroxylon*, *Ficus exasperate* Table 2.

**Table 1. Socio economic characteristics of respondent in the study area**

Parameter	Frequency	Percentage (%)
<b>Age</b>		
21-30	8	20.0
31-40	13	32.5
41-50	16	40.0
51 and above	3	7.5
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Sex</b>		
Male	30	75.0
Female	10	25.0
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Marital status</b>		
Single	9	22.5
Married	31	77.5
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Educational background</b>		
Primary	7	17.5
Secondary	26	65.0
Tertiary	7	17.5
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Experience(years)</b>		
1-5	4	10.0
6-10	7	17.5
10 years above	29	72.5
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Business ownership</b>		
Sole proprietorship	40	100
<b>Total</b>	<b>40</b>	<b>100</b>
<b>Nature of business</b>		
Wholesale	2	5.0
Retail	7	17.5
Wholesale and retail	31	77.5
<b>Total</b>	<b>40</b>	<b>100</b>

Source: Own authorship - Field Survey (2018)

**Table 2. Timber Species and volume marketed in the study area**

Common Name of species	Scientific Name	Quantity Marketed(m <sup>3</sup> )
Mahogany	<i>Khaya grandifoliola</i>	1669.90
Gmelina	<i>Gmelina arborea</i>	1669.90
Agba	<i>Daniellia oliveri</i>	2225.40
Obeche	<i>Triplochiton scleroxylon</i>	1669.90
Iroko	<i>Milicia excelsa</i>	1669.90
Iron wood	<i>Prosopis africana</i>	1669.90
Araba	<i>Ficus exasperata</i>	945.75

Source: Own authorship - Field Survey (2018)

**3.2.2 Location of supply in the study area**

The results in Table 3 reveals that highest proportion (92.5%) of timber supply to markets in the study area is sourced from open forest and the least proportion (7.5%) is sourced from forest reserve.

The result in Table 4 shows the various areas of supply of timber from the study area. It indicated that the highest proportion (27.5%) of supply comes from within Kogi state. This is followed by Abuja (20%), while the least proportion (2.5%) of supply comes from Akwa Ibom, Bauchi, Benue, Katsina, Borno, Niger and Zamfara.

**3.3 Analysis of Income from Timber Marketing in the Study Area**

The result in Table 5 shows the analysis of mean gross income per month from timber in the study

area. *Daniellia oliveri* recorded the highest mean return of 517, 005.99 per month while *Ficus exasperata* had the least mean monthly gross margin of 35,336.56. The mean gross margin of *Khaya grandifoliola*, *Milicia excelsa* *Prosopis africana*, *Gmelina arborea* and *Triplochiton scleroxylon* had the same mean returns of 466,270 per month.

**3.4 Determination of Timber Market Structure and Performance**

**3.4.1 Market structure**

*3.4.1.1 Market composition by association membership*

The result in Table 6 revealed that majority of the respondents 97.5% are members of the market association.

**Table 3. Location of timber supply in the study area**

Variables	Frequency	Percent
Forest reserve	3	7.5
Open forest	37	92.5
Total	40	100

Source: Own authorship - Field Survey (2018)

**Table 4. Areas of supply in the study area**

Areas of supply	Frequency	Percent
Kogi	11	27.5
Abuja	8	20.0
Kaduna	5	12.5
Kano	5	12.5
Adamawa	2	5.0
Delta	2	5.0
Benue	1	2.5
Awka Ibom	1	2.5
Bauchi	1	2.5
Katsina	1	2.5
Borno	1	2.5
Niger	1	2.5
Zamfara	1	2.5
Total	40	100.0

Source: Own authorship - Field Survey (2018)

**Table 5. Income analysis of timber marketing in the study area**

Type of Timber Species	1 Mean Cost Price	2 Mean Selling Price	3 Quantity (units)	4 Total Purchase 1x3	5 Total Sales (Gross Income) 2x3	6 Variable Cost per unit	7 Total Variable Cost 4+6	8 Gross Margin 5-7
<i>Daniella oliveri</i>	820.66	1078.75	2225.40	1,826,296.76	2,400,650.25	57,347.50	1,883,644.26	517,005.99
<i>Khaya grandifoliola</i>	827.55	1080.00	1669.90	1,381,925.74	1,803,492.00	57,347.50	1,439,273.24	364,218.76
<i>Milicia excelsa</i>	827.55	1080.00	1669.90	1,381,925.74	1,803,492.00	57,347.50	1,439,273.24	364,218.76
<i>Prosopis Africana</i>	827.55	1080.00	1669.90	1,381,925.74	1,803,492.00	57,347.50	1,439,273.24	364,218.76
<i>Gmelina arborea</i>	827.55	1080.00	1669.90	1,381,925.74	1,803,492.00	57,347.50	1,439,273.24	364,218.76
<i>Triplochiton scleroxylon</i>	827.55	1080.00	1669.90	1,381,925.74	1,803,492.00	57,347.50	1,439,273.24	364,218.76
<i>Ficus exasperata</i>	675.75	773.75	945.75	639,090.50	731,774.06	57347.50	696,437.50	35,336.56

Source: Own authorship - Field Survey (2018).

**Table 6. Distribution of respondents according to their membership association**

Membership of Association		Frequency	Percent
Valid	Yes	39	97.5
	No	1	2.5
	Total	40	100.0

Source: Own authorship - Field Survey (2018).

**3.4.1.2 Market concentration**

The Table 7 presents the result of market concentration of the timber market in the study area. The result indicates that the highest proportion (65.0%) of respondents accounted for 31.5% of total sales, followed by 20% of respondents which accounted for 27.2% of sales. In the same vein, 12.5% of respondents accounted for 16.7% while the least proportion of sellers (2.5%) of timber sellers possessed 24.6% of monthly sales at the market. The Gini-correlation coefficient of timber marketing obtained in the study area was 0.1552.

**3.4.2 Market performance in the study area**

Table 8 shows that majority (35%) of timber traders indicated that the amount of ₦200, 000 and above could facilitate start-up of timber business in the study area.

In Table 9, the result revealed that majority (85%) of the respondents indicated for availability of timber supply while 6% indicated otherwise.

In Table 10, the result revealed that majority (65%) of the respondents indicated there is regular supply of timber while 35% indicated that it is irregular.

**Table 7. Market performance of timber marketers**

Number of Sales in	Frequency distribution	Percentage of sellers (X)	CF	Sales	Percentage of Sales	Cumulative % of sales (Y)	XY
<=750000.00	1	2.5	2.5	113,166	24.6	24.6	0.0062
750001.00-3750000.00	5	12.5	15.0	76,820	16.7	41.3	0.0516
3750001.00-6750000.00	8	20.0	35.0	124,900	27.2	68.5	0.137
6750001.00+	26	65.0	100	145,130	31.5	100	0.65
	40	100		460016	100		0.8448

Source: Own authorship - Field Survey (2018)

$$GC = 1 - \sum XY$$

$$GC = 1 - 0.8448$$

$$GC = 0.1552$$

**Table 8. Market performance of timber marketers**

Amount for Business Set-up	Frequency	Percentage (%)
50,000	5	12.5
51-100,000	12	30.0
150,000-200,000	9	22.5
200,000 above	14	35.0
Total	40	100.0

Source: Own authorship - Field Survey (2018)

**Table 9. Availability of timber supply**

Availability of timber	Frequency	Percent
Yes	34	85.0
No	6	15.0
Total	40	100.0

Source: Own authorship - Field Survey (2018)

**Table 10. Degree of availability of timber supply**

Degree		Frequency	Percent (%)
Valid	Regular	26	65.0
	Irregular	14	35.0
	Total	40	100.0

Source: Own authorship - Field Survey (2018)

**3.5 Factors Influencing Marketing of the Species in the Study Area**

According to the result showed in Table 11, 47.5% of the species are resistant to insect attack. The resistance of the wood to attack can be attributed to the quality of hardness of the timber species especially the hard woods which makes them resistant to insect attack.

**3.6 Challenges of Timber Marketing in the Study Area**

Table 12 reveals the challenges of timber trade in the study area. It indicates that major challenge of timber marketing in the study area is low patronage (20.2%), this is followed by scarcity of wood species (18.0%), lack of supply of wood species (16.3%), increasing prices (12.0%), lack of access to credit (1.1%), faulty sawing of wood (1.1%), lack of capital (1.1%) while wood damage (0.6%) is the least challenge of timber marketing in Lokoja metropolis.

The socio-economic analysis revealed that majority of the respondents engaged in timber

markets were adults. This could be because the enterprise provides incomes that sustains livelihood of its participants. In a related study, [19] and [20] also established that traders in this trade are gainfully employed and are productive and energetic with greater potential for better performance to explore opportunities in their existing trade business.

The dominance of the male gender over the female is attributable to the hard and strenuous nature of the trade. This agrees with the findings of Adedokun *et al.*, [21] and Sambe, [22] that timber require tedious and require physical strength which could limit women participation. The reason for a greater proportion of the respondents being married is that timber provides income for them to carter for their household needs. This finding agrees with that of Akinbile [23] which states that marriage confers responsibility. Hence, the business provides income to meet household responsibilities. The implication for all the respondents been formally educated, defines their effectiveness towards their marketing activities, skill acquisition and book keeping positively [24,25].

**Table 11. Factors influencing the marketing of the species in the study area**

Variables	Frequency	Percentage (%)
Durability	9	22.5
High demand	12	30.0
Resistance to insect attack	19	47.5
Total	40	100

Source: Own authorship - Field Survey (2018)

**Table 12. Challenges identified in the study area**

Variables	Frequency	Percentage (%)
Lack of supply of wood species	29	16.3
Scarcity of demanded wood species	32	18.0
High taxes	26	14.6
Low patronage	36	20.2
Increasing prices	23	12.9
Transportation cost	25	14.0
Capital	2	1.1
Wood damage	1	0.6
Faulty sawing of wood	2	1.1
Credit	2	1.1
Total	178	100

Source: Own authorship - Field Survey (2018)



The indication by majority of the respondents having long years of experience implies that they have been involved in the trade for a long time and must have had good and acquired adequate skills, and hence timber marketing serves as a source of sustainable employment.

The high demand and preference of marketed timber species could be attributed to physical and mechanical properties utilized in the building construction industry in Nigeria. Adebara et al., [26] findings listed these timber species as those used in the building and construction industry. The mechanical properties and density such as moisture content, density and bending strength suitable for wide array of applications [19]. The reason for *Daniellia oliveri* as the most marketed species in the market could be due to the high demand and hence provides the highest income in the market. This also implies that *Daniellia oliveri* is the most exploited, meaning that it has the greatest tendency for depletion if not exploited on a sustainable basis while *Ficus exasperata* which is the least demanded species with the lowest income in the market has the least tendency for depletion. The reason for open forest being the highest source of supply according to the respondents is that there are very high restrictions placed forest reserves by the state government which makes it difficult to source timber in reserves. This makes open source readily available to merchants where timber can be sourced by just settling the community. This agrees with [27] that the main source of supply of traditional Nigeria timber such as Iroko, Mahogany, Obeche has been from areas outside the forest reserve.

The reason for Kogi state and Abuja having the highest proportion of supply to the study area could be attributed to proximity and availability of raw materials of these areas to the study area. The cost of transportation could be much less compared to the other areas, because the further the distance, the more marketing cost incurred and the less the profit and on the prevailing price [28,29,30].

The higher proportion of timber marketers being members of market association of implies that market structure is oligopolistic in nature. This poses barrier to entry in the market, [31] states that serious barriers to entry in to the market indicate oligopolistic tendencies. This mean that they are responsible for price determination of their products. This will lead to high profit accruing to the timber sellers as the timber prices will not be determined or controlled by the forces

of demand and supply. This usually results into imperfect market where the timber sellers are the price makers and hence monopolists.

The Gini- correlation coefficient of timber marketing obtained in the study area was 0.1552. This implies that the market is fairly equitable in distribution of timber sellers. It indicates that the measure of inequality of sales and incomes is low. The timber market however is imperfectly competitive with the market structure tending towards monopoly. The outcome will be bad market performance as a result of certain stakeholders which are sellers and in most cases control prices rather than the forces of demand and supply [32,33]. Timber marketing in the study area is profitable venture with good financial returns to the marketers. However, the market system is inefficient, the business is monopolised because sellers fix prices for buyers [34]. Hence, there is little influence of market forces of demand and supply within the timber market exemplifying bad market conduct and performance.

Though timber business is capital intensive, anybody with amount of money between fifty-one thousand naira and hundred thousand naira can invest in the timber trade as a means of livelihood. This implies that timber business in the study area is capital intensive and thus will require adequate capital for set up.

The fact that majority of the respondents agrees that timber is readily and regularly available for the trade in the study area confirms that the forest contains a wide range of timber species and is being exploited at an unsustainable rate provoking a continuous availability of timber species. According to Arowosoge et al., [35] and ITTO, [36], The increase in number of timber species harvested and marketed has grown in recent years led to prime species been largely logged out and has thus threatened the sustainability these timber species.

Based on the challenges of timber of timber business in Lokoja metropolis, low patronage ranks the highest as a result of the fact that the State in which the study area is, largely constitute of civil servants who solely depends on salary which are patronisers of the market has not been paid salary for several months and hence this has reduced their purchasing power causing very low patronage in the market. Hence, the low patronage can be attributed to the present economic challenges facing the country.

The Scarcity of demanded wood species could be attributed to the fact that demand of wood species is higher than the available wood species. This indicates therefore that the forest is not being harvested on a sustainable basis, the rate of harvest does not match the rate of regeneration because of the high depletion of forest and decline in the quality and quantity of species in markets [37]. General Wood and Veneers Consultants Ltd (GWVC), [38] reported that because of the decline in the commonly used timber species (CUTS) used for furniture and wood industries, the timber market has been forced to resort to the use of lesser known and predominant timbers species (Lesser-known species, LUTS) available in the localities of the markets.

The lack of supply of wood can be affected by factors such as season. According Langbour *et al.*, [39] timber supply is highly seasonal and this complicates felling operations and transportation. Multiple taxing system by the state Government has also been indicated as one of the major factors affecting the profit margin of the respondents. The remoteness of extraction areas in addition to bad roads and increased price of fuel and diesel and gifts given at check points has made transportation cost a challenge to the profit margin of the respondents.

Increasing prices also constitutes a challenge as this can affect demand and supply of the commodity. As prices increases, supply increases and demand falls. Hence this affects the profit margin of the traders. The challenge of lack of credit corroborates the finding of Akanni and Adetayo [40] who observed that access to credit facilities affects timber trade. Credit buying can be attributed to the current economic state of the country and the state that has affected their finances making unable to pay immediately for the commodity. Faulty sawings of wood by operators reduces the number of dimensions of wood that can be produced from a timber, thus, reducing profitability. Capital also affects the profit margin of respondents as timber business is quite capital intensive in the study area and this pose a challenge too to profitability. Wood damage can be caused by insects and in the process of offloading breakage can occur.

#### 4. CONCLUSIONS

Timber marketing provides a ready source of raw materials for both industrial and domestic purposes in Lokoja Metropolis. The business is male dominated and involved people in their

active ages. The result reflected that *Daniella oliveri* is the most marketed specie in the market with the highest tendency for depletion.

#### 5. RECOMMENDATIONS

The State government should make and implement afforestation and reforestation policies in the state in order to ensure sustainability of the forest for continuous timber supply. Also, private sector to investment in plantation forestry should be encouraged in order to reduce the pressure on available species and their chances for depletion especially *Daniella oliveri* species.

#### DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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