

FARMERS PERCEPTION AND SOCIO-ECONOMIC IMPORTANCE OF AN INDIGENOUS FRUIT TREE IN TWO AGROECOLOGICAL ZONES OF EDO STATE, NIGERIA. A CASE STUDY OF *CHRYSOPHYLLUM ALBIDUM* (G. DON)

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ABSTRACT: *This paper reports on farmers perceptions and the socio-economic importance of *Chrysophyllum albidum* in two agroecological zones of Edo state, Nigeria. From both zones, ninety (90) household where the fruit trees are produced on a commercial basis were selected through multistage random sampling technique. The data was obtained through a structured questionnaire, interview and focused group discussion with farmers, consumers and sellers of this fruit tree. The data obtained was subjected to descriptive analysis such as frequency, mode and percentages. Findings from the results revealed the economic importance of the species to the people, the desired characteristics of the fruits, the problems associated with the species and evidence of domestication in *C. albidum* trees especially in the rainforest zone. *C. albidum* fruit tree is economically important in both agroecological zones and contributes to the sustenance of livelihood of the rural populace. Furthermore, the size of *C. albidum* fruit and the taste influences the price of the fruit. Thus, Extension services could help farmers obtain greater benefits from this resource by promoting participatory domestication and advice on tree management.*

KEYWORDS: *Chrysophyllum albidum*, participatory domestication, agroecological zone, livelihood.

INTRODUCTION

Food security, health and the socio-economic welfare of both the rural and urban communities has been sustained through non-timber forest products (NTFPs) such as fruits, seeds, roots, stems, leaves and flowers (FAO, 1989) of indigenous species. The edible products from these forest tree species are important for food security, this is because it constitute important parts of a balanced diet as they are natural sources of food nutrients namely; protein, carbohydrate, minerals, dietary fibre, high level of vitamin C and sugar needed by man and animals etc., thus playing an important role in the nutritional balance of the people (FAO, 1989). Furthermore, the barks, leaves, fruits, roots, seeds, etc. could be used to cure a variety of sickness and diseases (FAO, 1998; Adewusi, 1997), thus contributing to the health care delivery. NTFPs contribute significantly to rural poverty alleviation by providing employment and enhancing economic empowerment of rural dwellers through the collection, processing and marketing of their products such as fruits, seeds, leaves, root etc. (Franzel, *et al.*, 2008). One of the forest food tree species that has been noted to have a high socio-economic importance in Nigeria is *Chrysophyllum albidum*.

Description of species

African star apple (*C. albidum* G. Don) is a tropical edible fruit tree belonging to the family of Sapotaceae which has up to 800 species and make up almost half of the order (Ehiagbonare *et al.*, 2008). The species is primarily a lowland rainforest tree and its natural occurrences have been reported in various ecological zones from Sierra Leone to East Africa (Bada, 1997). *C. albidum* is also among the forest tree species that provides Non Timber Forest Products (NTFPs) of immense domestic importance to rural and urban dwellers in West and Central Africa, with great export potentials (Nwoboshi, 2000). The economic importance of *C. albidum* has increased in recent years due to awareness of its economic, nutritional, social, traditional and medicinal value (Onyekwelu and Stimm, 2006) thus, the fruit plays an important role in household food security. Wild harvesting of these fruits from forests and semi domesticated trees growing on-farm and homesteads can substantially boost rural income and employment opportunities (Leakey *et al.*, 2005).

Despite the importance of this species in terms of vitamin, food security and income generation, the genetic base of this species is being reduced as a result of deforestation, long gestation period and its difficulty in germination. Its seeds are recalcitrant with hard protective coats lined with a wax-like layer which makes it difficult for water to get into the embryo therefore making the seed dormant. However, the high economic values of *C. albidum* has led to intense exploitation of its fruits resulting in scarcity and a declining rate of its availability, causing the species to be classified as endangered or threatened (FORMECU, 1999); except some conservation measures is applied to mitigate the depletion of this all important forest food tree. This study therefore aims at quantifying the socio-economic importance of *Chrysophyllum albidum* in the livelihood of the rural people.

MATERIALS AND METHODS

General Environment of the study area

The study was carried out in the derived savanna and rainforest zone of Edo State, Nigeria. The state is made up of 18 Local Government Areas (L.G.A) with an area of about 19,794 kilometers. Geographically, Edo state lies roughly between longitudes 05⁰ 04'E and 06⁰ 43'E and latitudes 05⁰ 44'N and 07⁰ 34'N. It is bounded on the north by Kogi state, on the west by Ondo state, on the south by Delta state and on the east by both Kogi and Anambra states.

The state has a tropical climate characterized by two distinct seasons i.e. the wet and dry seasons. The temperatures across the state are relatively high with a very narrow variation in seasonal and diurnal which ranges from 22⁰C to 36⁰C (www.edoworld.net/edotourismweather.html). The climate is humid tropical in the south to sub-humid in the north. Vegetation in the North, is mainly derived savannah. On higher levels, the soil is gravely sandy towards the Orle valley. The Esan plateau is made up of diverse vegetation, savannah in the north and rainforest in the south. Soil type ranges from low productive sand in the south-east to the fertile clayey soil in the North-West.

Sampling procedure

A multistage sampling technique was used to collect the data involving a three – stage design procedure.

Stage 1: The division of the study area into two (2): derived savanna zone and rainforest zone to represent primary selection units which denote the strata from where the data were collected. Each primary selection unit denote a stratum.

Stage 2: A purposive selection of 3 L.G.A from each stratum (i.e. each of the agroecological zones where *C. albidum* are produced on a commercial basis); to obtain information on the economic importance of the *C. albidum* fruits, the desired fruit characteristics preferred by the consumers and sellers of *C. albidum*, the problems associated with the species and selecting the elite ‘plus trees’ for domestication.

Stage 3: Simple random selection of 10 respondents in each L.G.A in the derived savanna (stratum) and 20 respondents in each L.G.A in the rainforest zone (stratum). Further details of sampling procedures are summarized in Table 1. Interviews was conducted with *C. albidum* farmers, consumers and marketers and finally focused group discussions, these information were used to obtain quantitative and qualitative information on the level of cultivation, marketing and conservation of the species in the study area.

Data Collection

The main instrument of data collection was a structured and pre-tested questionnaire. Ninety questionnaires (90) were administered interpersonally to the respondents in the study area (Table 1). Participatory methods were used to gather information from farms. These methods included: farm visits, structured interviews with households. The structured questionnaires was conducted at 3 levels; Section A, the individual characteristics of the farmers’; Section B, knowledge on the species and Section C, consumers and sellers preference on the fruit characteristics of *C. albidum*.

Analytical techniques

Information from the questionnaires was coded to obtain quantitative value for analysis. Descriptive statistical tools such as frequency, mode and percentages were used to describe the socio-economic importance of *Chrysophyllum albidum* in the derived savanna zone and rainforest of Edo State, Nigeria.

TABLE 1: Sampling Design

STATE	AGROECOLOGICAL ZONE (STRATUM)	L.G.A	GPS	Respondents
Edo	Rainforest	Uhunmwode	N06 ⁰ 43.210' E05 ⁰ 56.660' 279 m	20
		Esan West	N06 ⁰ 46.934' E06 ⁰ 50.004' 242 m	20
		Esan Central	N06 ⁰ 47.052' E06 ⁰ 17.052' 31 m	20
	Derived savanna	Owan west	N06 ⁰ 54.021' E05 ⁰ 56.199' 246 m.	10
		Owan east	N06 ⁰ 58.112' E6 ⁰ 02.083' 135 m	10
		Etsako West	N07 ⁰ 07.502' E06 ⁰ 37.088' 220 m	10
TOTAL				90

RESULT

The results obtained from the study on the socio-economic characteristic of consumers and sellers of *C. albidum* fruits are illustrated below.

Table 2 below revealed that majority of the respondents in derived savanna and rainforest zones were males (66.7% and 75.0%) respectively, their ages varies from 30 to 50 years and above. The dominant age group of the respondent was between the ages of 41-50 years (43.3% and 50%) respectively in both zones. Majority of the respondents were married (73.3% and 80%), and their highest level of education was the primary educational level (50% and 56%) in derived savanna and rainforest zones respectively. Results from the household size revealed that majority of the respondents (40% and 58.3%) in both agroecological zones respectively had a household size of 7 – 9 persons and that their primary occupation was mostly that of crop farming (50% and 68.3%) in both zones respectively (Table 2).

Table 2: Demographic characteristics of respondents (%).

Characteristics	Categories	Derived savanna	Rainforest	Total
Gender	Male	66.7	75.0	72.2
	Female	33.3	25.0	27.8
Age classes	31-40	43.3	23.3	30
	41-50	43.3	50.0	47.8
	>50	13.3	26.7	22.2
Marital status	Single	10	6.7	7.8
	Married	73.3	80	77.8
	Divorced	0	1.7	1.1
	Widow(er)	16.7	11.6	13.3
Education	No formal education	30.0	35.0	33.3
	Primary education	50.0	56.7	54.4
	Secondary education	20.0	8.3	12.2
Household size	1-3	3.3	3.3	3.3
	4-6	46.7	35	38.9
	7-9	40	58.3	52.2
	10-12	10	3.3	5.6
Religion	Christian	33.3	90	71.1
	Muslim	66.7	10	28.9
Primary occupation	Crop farming	50	68.3	62.2
	Livestock farming	13.3	3.3	6.7
	Fish farming	3.3	3.3	3.3
	Agric	33.3	25	27.8
	processing/trading			

Table 3 below revealed relevant information that were obtained on farm characteristics and practices managed on the farmer's field. Majority of the respondents (86.7% and 53.3%) in derived savanna and rainforest zones respectively had naturally regenerated trees of *C. albidum* on their farm land. There is no plantation of this species, it is known as an accompany or associated tree crop in farmer's farm; the number of trees distributed in each of these farmer's farm ranged between 1 to 11 trees, only few farmers (3%) in both zones had above 7 trees (Table 3). Productivity of this fruit tree varies in both zones, each of this mother trees can produce fruits between 3 to 9 baskets; each of these basket with fruits are approximately $\pm 42.5\text{kg}$ while the number of fruits contained in each basket is ± 640 fruits. The weight of an empty basket and rope is 3kg. The result obtained from the productivity of the mother tree revealed that only 30% and 23% of the respondents in both zones respectively had bumper harvests (7-9 baskets) per tree yearly. The fruits were sold mostly in basket, only few farmers (33.3% and 40%) in both zones realized above ₦ 10,000 (\$28) from sales of the fruit at farm gate. It was observed that the price of this species both at the farm gate or urban market was highly dependent on the size and taste of the fruits.

From the results, 100% of respondents in both zones were aware that *C. albidum* has a high economic importance; the fruit tree could be used as food, medicine and also for cultural purposes such as rattles in ankles of traditional dancers. With respect to the different uses, the fleshy pulp of the fruit had the highest indication of usage for food among the respondents (Table 3). The result also showed age classification of sampled trees which ranged between 5 - 40 years. There was no trees between the age bracket (1-15) years in derived savanna zones while in the rainforest zones 10% of respondents had trees within the age brackets (11-15 years). The dominant age bracket (20% and 16.7%) was 26-35 years in derived savanna and rainforest zones.

The results also captured the different fruiting period of *C. albidum* trees, there are three fruiting periods of this species. Although, majority (50% and 51.7%) of the respondents had a fruiting period of January to February in both zones. However, it is worth nothing that the derived savanna zone had more early fruiting trees (November to December) while the rainforest zone experienced more of late fruiting trees (March to April).

Table 3: Farm characteristics of respondents

Characteristics	Categories	Derived Zone		savanna Rainforest Zone	
		Freq.	%	Freq.	%
Farm Type	Home garden	21	70.0	14	23.3
	Cash crop farm	9	30.0	46	76.7
Method of Cultivation	Natural regenerated	26	86.7	32	53.3
	Cultivated	4	13.3	28	46.7
Ownership of trees	1-2 trees	25	83.3	45	75.0
	3-4 trees	4	13.3	9	15.0
	5-6 trees			4	6.7
	7-11 trees	1	3.4	2	3.3
Productivity	Bumber harvest (7-9 basket)	9	30.0	14	23.3
	Moderate harvest (4-6 basket)	18	60.0	43	71.7
	Low harvest (1-3 basket)	3	10.0	3	5.0
Annual Income	<N5000	5	16.7	1	1.7
	N 5000- N 10,000	15	50.0	35	58.3
	>N 10,000	10	33.3	24	40.0
Economic importance	Food, Medicine, Cultural	30	100.0	60	100.0
	Food & Medicine	27	90	50	83.3
	Cultural	7	23.3	20	33.3
Age classification	5-10 years	0	0	1	1.7
	11-15 years	0	0	6	10.0
	16-25 years	4	13.3	8	13.3
	26-35 years	20	66.7	35	58.3
	>35 years	6	20.0	10	16.7
Fruiting period	Early fruiting	10	33.3	14	23.3
	Normal fruiting	15	50.0	31	51.7
	Late fruiting	5	16.7	15	25.0

Table 4 below shows results on the fruit characteristics of *C. albidum*. Variations in the fruit colour was observed during the study which ranged from orange, yellow and yellowish-orange; Although, most of the respondent (53% and 46.7%) in derived savanna and rainforest zones respectively indicated that the fruits were orange in colour. Also, variations were also observed in the fruit size of *C. albidum*. The sizes of the fruit varies from <40g to 110g, However, majority of the respondents (66.7% and 50%) in derived savanna and rainforest zones respectively indicated that their fruits were medium (40- 79g) in size.

Furthermore, an organoleptic test was carried out on fruit taste of *C. albidum* fruits by a five-man panel to indicate if the fruits were very sweet, sweet or sour. The organoleptic test revealed that majority (63.3% and 61.7%) of respondents in derived savanna and rainforest zones respectively indicated that the fruits were sweet.

Table 4: Respondents perception of fruit characteristics

Characteristics	Variables	Derived savanna		Rainforest Zone		Total	
		Freq.	%	Freq.	%	Freq.	%
Fruit Colour	Yellow	5	16.7	9	15.0	14	15.6
	Yellowish orange	9	30.0	23	38.3	32	35.6
	Orange	16	53.3	28	46.7	44	48.9
Fruit Size	Large	3	10.0	12	20.0	15	16.7
	Medium	20	66.7	30	50.0	50	55.6
	Small	7	23.3	18	30.0	25	27.8
Fruit Taste	Very sweet	5	16.7	9	15.0	14	15.6
	Sweet	19	63.3	37	61.7	56	62.2
	Sour	6	20.0	14	23.3	20	22.2

DISCUSSION

Socio-economic characteristics of respondents

The results on the individual characteristics of the respondents showed that farmers who cultivate *C. albidum* trees were dominated by males in the two agroecological zones. Reason being that males are more likely to have access to land for production of tree crops while the women participates mainly in the collection/harvesting, processing and marketing of NTFPs (Adekunle, 2009; Odebode, 2005). The age bracket of the respondents were within 31-50 years, which is the active and agile stage of a man to cultivate tree crop for food and income, hence their involvement in *C. albidum* cultivation. This finding corroborates with that of Chukwuji *et al.*, (2000) who

reported that the average age of farmers was 40 years in Anambra State, Nigeria. Majority of the respondents were married in both zones implying that these farmers have a sense of responsibility by engaging in the cultivation of this species to earn extra income for the welfare of their families (Afolabi, 2010). Education is known to have a positive effect on farmer's attitude which may lead to improvement in productivity. Most respondents had primary education, there is need for more effort to be geared towards creating awareness on disseminating agroforestry farming techniques using participatory method; this is an important factor that will eventually lead to increase in household food security and income generating opportunities (Dauda *et al.*, 2009). The household size of the respondents was between 4-6 and 7-9 persons in their families in each agroecological zone respectively. Thus, these farmers has access to family labour and to a reasonable extent the cost of farming operations will be reduced (Agwu and Edun 2007).

Farm characteristics

The study showed that *C. albidum* trees were found more in home gardens in the derived savanna zone as shade trees or perennial crops while in the rainforest zone it was found more in cash crop farms as companion tree crop in agroforestry systems due to its overall value and expected benefit. This is an evidence of integration into the social and economic life of the people (Boateng and Yeboah, 2008; Franzel *et al.*, 2008; Onyekwelu, *et al.*, 2011; Pye-smith, 2010). In the various study sites, farmers in the derived savanna zone indicated that no deliberate efforts were made to cultivate the species other than spontaneous natural regeneration, thus, mother trees of the species dominant in the derived savanna were above 26 years of age. Although, field observation revealed that in the rainforest zones there were more of the younger trees between 5-25 years with the fruit sizes of the mother tree weighing up to 98 g. Thus, there is an element of positive selection in the conservation and domestication of the species by farmers, which is evidenced by the fact that fruits of domesticated trees were found to be generally bigger and sweeter. These are evidences that farmers in the rainforest zone have through mother tree selection made genetic gains in fruit weight. The study also revealed that on the average in both agroecological zones, most of the farmers had 3 trees of *C. albidum*, however, only few (3%) farmers had more trees (7) in the rainforest zone. Participatory efforts should be encouraged in some of these innovative farmers towards the cultivation and conservation of this species. Following field observations, probable reasons for the low number of trees per farmer may be attributed to reduction in their genetic base due to difficulty in regenerating the seeds. In the study area, productivity of the species was mainly a moderate harvest of 4-6 baskets in both agroecological zones. Although, variation occurs in the productivity of the trees in alternate years due to the destructive mode of harvesting which is cutting down the branches to enable them harvest the fruits with ease.

From field observations and focused group discussion with consumers and sellers, it was evident that there were few superior trees (33% and 40%) in derived savanna and rainforest zone respectively; with good characteristics for vegetative propagation as fruits producing cultivars conforming well to the desired traits of large fruit with good taste. Leakey *et al.*, (2002) opined that in the long term, these desired traits in indigenous tree crops could be achieved through breeding but in the short term, it is more practical to use clonal approaches to tree improvement and to propagate elite tree with desirable combinations of traits.

The fruiting period / maturation of *C. albidum* is usually between November and April but it could be earlier or later depending on the tree and agroecological zone. From the results, both zones experienced the 3 fruiting periods though an earlier fruiting of the species was experienced more in the derived savanna zone while a late fruiting was experienced more in the rainforest zone. Probable reason for the early ripening in the derived savanna zone and proceeding to the rainforest zone might be due to differences in rainfall, temperature, soils, but there may also be an effect of the light environment, as in the derived savanna zone, the species formed in the upper storey. It is also clear that trees differed in their peak of fruiting within site, suggesting some genetic differences in ripening between trees.

CONCLUSION AND RECOMMENDATION

The economic importance of *Chrysophyllum albidum* fruit is reported in this paper. This fruit tree has proven to possess socio-economic values which will boost income especially for women and youth and further serves as safety net particularly during shortfall in agricultural production and reduce malnutrition. Therefore, establishing a participatory domestication programme for this species in addition with some priority indigenous forest food trees in the study area will go a long way in promoting the benefits of this species which could significantly contribute in the sustenance of livelihood and income generation by small scale farmers especially in the rural areas in Nigeria.

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