Utilization and Commercialization of Two MPTS (*Adansonia digitata* and *Borassus aethiopum*) in Sahelian Environment of Borno State, Nigeria

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ABSTRACT

This paper presents the results of the study carried out on the various ways in which two multipurpose tree species(MPTS): Adansonia digitata and Borassus aethiopum were being used and how trading in MPTS products contributed to the income of the inhabitants of thirty rural communities in Sahelian environment of Borno State, Northeastern Nigeria. In the study, we sought to ascertain the components of the trees that were used domestically. Those that were sold and those that were used in cottage industries. We also studied the effect of MPTS on mean annual income and the effect of annual seasonal changes (rainy to dry) on both income and availability of raw materials. We also sought to understand the people perception on deforestation, role of MPTS in food security and poverty alleviation, and the perception of rural communities in reforestation. The results showed that every major component of both species (Wood, bark, fruits, exudates, leaves, seeds, roots, flower and ash) were utilized. In addition to what sold; assorted products were derived for domestic uses. The mean annual income of those who traded in MPTS products was significantly higher than that of those who did not. Income during the rainy season was higher than income during the dry season, but mean annual income was not affected by trading experience. Although both species were seldom felled, all the respondents were willing to plant more of the tree and were eager to take advantage of recent technological advancements.

Keywords:
Agroforestry, poverty alleviation, income, food security, multipurpose species.

INTRODUCTION

The significant role of agroforestry in poverty alleviation and food security in rural communities is well know. Many studies (Zira *et al*., 2013; Parnwell,2005; Parnwell and Oginisako, 2005;ICRAF,2005; Gebauera *et al*., 2002; ICRAF, 1992; Arifalo, 1984) have also shown that between the cropping seasons in many African farming system, farmers rely alternative food products that include trees, fruits, animals and sale of non-wood products to earn a living. The use of multipurpose tree species, MPTS (so called because of numerous benefits derived from them), by indigenous people have played an important role in food and nutritional supplement in dry areas especially during droughts when there is food shortage (Muok *et. al*.,2000). Although there is a consideration awareness among farmers and rural communities on the value and uses of fruit tree species, indigenous fruits in the Sahelian environment of northeastern Nigeria are mostly harvested from the wild with little or no deliberate planting for domestication purposes (Tella *et al*., 2005), as such, most of what is used to meet a wide range of needs is collected from the wild in an unsustainable manner.

The possibility of alternative between food sources and income generating activities (especially as occasioned by seasonal changes) is very pertinent in sahelian environment (Oni, 2001), where there is low development indicators against high incidence of poverty. In such environment, more than 60% of the population live below poverty line, and many of the inhabitant are often faced with high incidence of poverty caused by conflicts, harsh climatic condition such as low and unreliable rainfall, frequent droughts and fragile ecosystem resulting in low and declining land productivity (Zira *et al*.,2013; Parnwell,2005; Tella and Tella, 2001). Frequent crop failure in Sahelian environment often result in the poor nutrition of local people and the need to find other resources for getting enough food for the growing population and income to purchase other life necessities sometimes become very dire. Some authors (Leaky and Sommons, 1998; Shackelton *et al.*, 2000) have shown that trade in MPTS could significantly alleviate poverty in rural communities. In the dry North of Nigeria, little attention has been paid to non- export crop species like wild fruit trees while very indigenous species have been promoted or researched enough to the level of field production and none that we know of is being used in a government-supported afforestation programme.

In this paper, we hope to emphasize the significance of two very important fruit-bearing trees in the study area: *Adansonia digitata and Borassus aethiopum* to the sustenance of people in the Sahelian environment of Borno State in Northern Nigeria. This is expected to stimulate increased commitment of researchers and appropriate governmental and non-governmental agencies towards at least three pertinent issues: (i) conservation and improvement of indigenous genetic resources in Sahelian environment. (ii) field trials / domestication and ultimately the reforestation of the dry north with these two and / or similar species, and (iii) sustainable development and production of export quality products that are derived from indigenous tree species (while taking advantage of indigenous technology).

METHODOLOGY

Description of the study area

The survey took place in thirty villages that were selected within the Sahelian environment of Borno State, Nigeria. The region lies between latitude 11^0 to 14^0 North and longitude 10^0 to 14^0 East of the green wish meridian (BOSADP, 2003).It is located in the North Eastern part of Nigeria and shares international border with the Republic of Chad to the North-East, Cameroon to the East and South-East and Republic of Niger to the North. It is bounded by Adamawa State to the South, Yobe State to the West and Gombe State to the South. The Sahelian environment consists of ten Local Government Areas namely: Abadam, Gubio, Guzamala, Magumeri, Marte, Mobbar, Monguno, Nganzai, Ngala and Kukawa and has the total land area of 69,436km^2 inhabited by 2,243,068 people (2006 census projection for 2013). The climate of the area is characterized by dry and hot weather with an annual temperature ranging from 25-37^{o}c (Gambo, 2007). However , the months of November to February, are relatively could. Annual rainfall is generally low and highly variably with less than 500mm per annum (Odo *et al*., 1999; Odo and Leghe, 1988). Naturally, vegetation is savannah woodland with shrubby trees and annual grasses. Agriculture is the mainstay of the Sahelian environment's economy.

Data collection

The Sahelian environment comprised of ten Local Government Areas (LGAs), out of which six were randomly selected. Five villages were randomly selected within each LGA resulting in a total of 30 villages/communities. Enumeration was done by means of an interview schedule (questionnaire) while focused group discussions were held (involving village heads where possible) to gather additional information. Pretesting was done in ten of the villages while for the actual enumeration, twenty (20) people were interviewed in each of the thirty (30) communities, resulting in a total of 600 respondents data was interpreted using descriptive analysis, while student's t-test was done to compare periodic incomes (case 1: before becoming a trader in MPTS vs after becoming a trader in MPTS, case 2: estimated income during the rainy season vs estimated income during the dry season). Correlation analysis was also done to test the relationships between estimated annual income, estimated seasonal income and trading experience. All statistical analyses were done using Microsoft excel 2007 analysis Toolpak.

RESULTS AND DISCUSSION

The basic demographic information on the 600 respondents are shown in Table 1. Eighty five (85%) of the respondents used different components of the trees to meet domestic needs and also traded in products derived from the trees while a few (2.2%) claimed they did not make use of anything made from either of the two MPTS. Table 1 also shows that 12.7% used the trees for subsistent purposes but did not engage in trading. Most of the people (63.4%) were middle-aged. Eighty three (83%) of all the respondents were married while 58.3% were female and 41.7% were male. Table 2 shows that most of the respondents (83%) used products made out of *A.digitata* fruits and leaves, while 64.4% of them used the leaves (41.7%) and the exudates (23.7%) of *B.aethiopum* more than other components. The same trend was observed for profitability in trade: 60% and 32.4% of the respondents profited most from products made from *A.digitata* leaves and fruits respectively, while 30% of the people profited most from fruit of *B.aethiopum*, its seeds were most profitable (Table 2). In addition, most of the people (82%) exploited *A.digitata* in the wild, while 73.3% of the people derived their products from *B.aethiopum* growing on farmlands (Table 2). Very little of the labour (19.7% and 11% respectively) used in utilization of *A.digitata* and *B.aethiopum* was hired (table 2)

Table 1: Demographic distribution of respondents with respect to the utilization and commercialization of the two MPTS*

category	Description	Utilization only		Trade only		Utilization and trade		Total	
		F	%	F	%	F	%	F	%
Age	20-30 yrs	18	3.0	8	1.3	102	17.0	128	21.3
	31-40 yrs	22	3.7	0	0.0	174	29.0	196	32.7
	41-50 yrs	20	3.3	4	0.6	160	26.7	184	30.7
	Above 50 yrs	16	2.7	2	0.3	74	12.3	92	15.3
	Total	76	12.7	14	2.2	510	85.0	600	100.0
Gender	Male	26	4.3	14	2.2	210	35.0	250	41.7
	Female	50	8.4	0	0.0	300	50.0	350	58.3
	Total	76	12.7	14	2.2	510	85.0	600	100.0
Marital status	Single	18	3.0	2	0.3	82	13.7	102	17.0
	Married	58	9.7	12	1.9	428	71.3	498	83.0
	Total	76	12.7	14	2.2	510	85.0	600	100.0

Source: field survey 2013. *F= frequency, %= percentage, N=600

Table 2: Distribution of respondents according to most utilized tree components perceived as most profitable. Sources of raw produce. Source of labour for derived products

Category	Description	*Adansonia digitata*		*Borassus aethiopum*	
		F	%	F	%
Most utilized Tree component					
	Bark	8	1.3	2	0.3
	Bole (wood)	60	10.0	28	4.7
	Exudates	-	0.0	142	23.7
	Flower	4	0.7	68	11.3
	Fruit	236	39.3	250	41.7
	Leaves	262	43.7	104	17.3
	Roots	8	0.7	4	0.7
	Seeds	26	4.3	2	0.3
	Total	600	100.0	600	100.0
Most profitable Tree component					
	Bark	6	1.0	-	0.0
	Bole (wood)	38	6.3	22	3.7
	Exudates	-	0.0	92	15.3
	Flower	-	0.0	-	0.0
	Fruit	194	32.4	180	30.0
	Leaves	360	60.0	78	13.0
	Roots	-	0.0	-	0.0
	seeds	2	0.3	228	38.0
	total	600	100.0	600	100.0
Sources of Raw Products					
	From wild	492	82.0	238	39.7
	Farmland (naturally occurring)	376	62.7	212	35.3
	Planted tree	130	21.7	440	73.3
	Others (e.g. from children)	24	4.0	70	1.7
Sources of labour for Derived products#					
	Family members	414	69.0	492	82.0
	Hired labour (cottage industry)	118	19.7	66	11.0
	Communal effort	208	34.7	180	30.0

Source: field survey 2013 # multiple responses *F=frequency, %=percentage, N=600

The perception of people on issues such as deforestation, role of MPTS in poverty alleviation and the participation of rural community in environmental amelioration are presented in Table 3. Many of the people (51.3% and 43.3%) did not agree that either *A.digitata* or *B.aethiopum* could become extinct. However, almost all (94.7% and 95.7% respectively) expressed their constant need of the MPTS (Table 3). In the same vein, almost all the respondents showed their eagerness to adopt better technologies, as much as they also agreed that the MPTS had increased their incomes, that they were beneficial and needed to be regenerated. Few of the people (15.3% and 27%) had ever planted either of *A.digitata* or *B.aethiopum* respectively. Table 4 shows that respondents gave varying reasons for overexploitation of forest resources. Many people (48.7% and 57.7%) opined that seasonal changes affected both usage and trade in *A.digitata* and *B.aethiopum* respectively (Table 3). The distribution of respondents with regards to their perception of the effect of MPTS trading on their income, and the effect of seasonal changes on trade is shown in Table 4

Table 3: respondents' perception of issues such as deforestation, role of MPTS in poverty alleviation and the participation of rural communities in environmental amelioration.

Category	Description	*Adansonia digitata*		*Borassus aethiopum*	
		F	%	F	%
This kind of tree can become extinct	YES	292	48.7	334	55.7
	NO	308	51.3	266	43.3
	Total	600	100.0	600	100.0
My village can do without this kind of tree	YES	32	5.3	26	4.3
	NO	368	94.7	574	95.7
	Total	600	100	600	100
Trading in this kind of tree has increased my income a lot	YES	600	100.0	592	98.7
	NO	-	0.0	8	1.3
	Total	600	100	600	100
This kind of tree is beneficial in many ways	YES	600	100.0	598	99.7
	NO	-	0.0	2	0.3
	Total	600	100	600	100
I have planted this kind of tree before	YES	92	15.3	162	27
	NO	508	84.7	438	73
	Total	600	100	600	100
I agree that this kind of tree needs to be regenerated	YES	432	72.0	580	96.7
	NO	168	28.0	20	3.3
	Total	600	100	600	100
I am eager to adopt better ideas/technology	YES	538	89.7	576	96.0
	NO	62	10.3	24	4.0
	Total	600	100	600	100
Seasons affects usage and trading in tree products	YES	292	48.7	346	57.7
	NO	228	38.0	206	34.3
	Silent/undecided	80	13.3	48	8.0
	Total	600	100.0	600	100.0
# perceived reasons for overexploitation and deforestation	Increased demand	412	68.7	582	97.0
	Lack of substitutes	102	17.0	206	34.3
	Cultural preference	214	35.7	198	33.0
	Population growth	452	88.7	524	87.3
	Poverty	136	22.7	24	4.0
	Increased market value	396	66.0	572	95.3

Source: field survey 2013. # Multiple * F= frequency, %=percentage, N= 600

Table 4: Distribution of respondents based on the estimated annual income according to the Period of their participation in MPTS trade

Period	< ₦5,000		₦5,001-₦10,000		₦10,001-₦20,000		₦20,001-₦30,000		>₦30,000		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Income before MPTS Trade (₦)	302	50.3	166	27.7	80	13.3	48	8.0	4	0.7	600	100.0
Income as MPTS trader (₦)	76	12.7	94	15.7	278	46.3	110	18.3	42	7.0	600	100.0
Income in rainy season(₦)	52	8.7	198	33.0	240	40.0	88	14.6	22	3.7	600	100.0
Income in dry season (₦)	42	7.0	126	54.4	162	27.0	62	10.3	8	1.3	600	100.0

Source: field survey 2013 * F=frequency, %=percentage, N=600

Before trading in MPTS, 78% of the respondents earned less than ₦ 10,000 while only 8.7% of them earned above ₦20,000. However, after becoming MPTS traders, only 28.4% still earned less than ₦10,000 while 25.3% now earned above ₦20,000. Table 5 also showed that of that of the 600 respondents, only two (2) non-traders earned above ₦30,000, but with MPTS trading, 21 people earned as much. In addition, earning during both the rainy and dry seasons is shown in Table 4. Correlation coefficients for earnings during the various trading periods, and trading experience are shown in Table 5. The results show that earnings during the periods are significantly related. This agrees with the results of Mouk *et al*; (2000) and Shackelton *et al*; (2000). The duration of trade experience did not significantly affect amount of money earned in MPTS trading (Table 5). This also agree with the result of Ajewole and Aiyeloja (2004) who showed that age did not affect the derivation of benefits from forest resources.

Table 5: Correlation coefficients of the relationships between estimated periodic income and experience.

	Income of MPTS trader	Income of non traders	Income in the rainy season	Income in the dry season	Trade experience (yrs)
Income of MPTS traders (₦)	1				
Income of non-traders(₦)	0.736	1			
Income in the rainy season(₦)	0.796	0.691	1		
Income in the dry season (₦)	0.755	0.688	0.719	1	
Trade experience(yrs)	0.357	0.404	0.224	0.293	1

Table 6 shows the results of student's t-test to compare mean annual earnings of MPTS traders (₦8,606.67) and non-traders (₦ 16,050), as well as their earning during the rainy (₦13,500) and dry (₦ 11,583.33) seasons. Pearson's correlation coefficient (0.736) and the calculated t-stat (21.238) show that mean annual earning of MPTS traders was significantly higher than of non-traders. Table 6 also shows that mean annual earnings during the rainy season was significantly higher than during the dry season (Pearson's correlation coefficient was (0.685) and the calculated t-stat (6.828).

Table 6: results of students' t-test to compare periodic incomes of respondents

	Income of MPTS trader	Income of non traders	Income in the rainy season	Income in the dry season
Mean (₦)	8606.67	16.050	13,500	11,583.33
Variance	46968517.28	80315217.39	48464882.94	47548216.28
Observations	600	600	600	600
Pearson correlation	0.736		0.685	
Degree of freedom	299		299	
t Stat	21.238		6.828	
t Critical one-tail	1.649		1.649	
t Critical two-tail	1.968		1.968	

Observations (SWOT analysis) from focused group discussions held during the study.

***Strength*:** all year round, there is continuous supply of most of the tree products with a corresponding demand in the local markets. Simple processing methods are already in place and the people are positive towards sustainable use of MPTS. Medicinal and nutrition values of MPTS are well appreciated and there are few or no gender issues about MPTS usage.

***Opportunities*:** the willingness to domesticate MPTS is very high and land for forest regeneration is abundant. Many people are eager to improve their income while most cultures and beliefs favour increased productivity and sustainable utilization. Many people are willing to adopt better technologies and genetic improvement of indigenous germplasm is highly desirable, especially if integration of indigenous knowledge with scientific advances is done.

***Weaknesses*:** MPTS are not easily propagated in arid regions while seedlings of indigenous fruit trees are often not available in local nurseries. Many products derived from MPTS are still poorly priced, and marketing outlets in urban areas are difficult to access.

***Threats*:** increasing population growth, poverty, persistent domestic needs and climate conditions predisposes the people towards deforestation. Most current reforestation efforts focus on exotic species and the practice of norrnadism seems to discourage long term local commitment in some areas.

Indigenous Knowledge: researches could benefit a lot from the local people. For instance, some have mastered the art of estimating the sweetness of fruits at mere sight. The attitudes of some animals to some forest resources are locals identify many drugs and foods. Superstitions could also play a major role in germplasm conservation. For instance, some communities have belief that whoever fells three mature baobab trees in succession is bound to die mysteriously, thus inadvertently reducing pressure on the species.

CONCLUSION

Trade in MPTS could offer an indirect way of conserving forest germplasm in dry rural areas of North eastern Nigeria. This is because it might be easier to get the cooperation of people in the sustainable usage of species that offer multiple benefits, especially if it includes revenue generation. If *Adansonia digitata* and *Borassus aethiopum* are used in extensive reforestation programmes in Sahelian environment of Nigeria, they have the potential to provide ample income and many useful products all year round to many people. Another advantage in MPTS trading is that profitability does not depend on duration of trading experience. In addition, if many of the products derived from the two MPTS studied are improved with recent technological advances, they probably could be a means of enhancing national food security, health delivery, poverty alleviation, and environmental sustainability.

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