Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

http://dx.doi.org/10.4314/jae.v18i2.6

Exploitation of Bush Mango (*Irvingia wombolu* and *Irvingia gabonensis)* Among Rural Household in Enugu State, Nigeria

Chah J.M., Ani N. A, Irohibe J. I and Agwu A.E
Department of Agricultural Extension University of Nigeria Nsukka
E-mail: jane.chah@unn.edu.ng

Abstract

The study was undertaken to assess the exploitation of Bush Mango *Irvingia gabonensis and Irvingia wombolu (ogbono) among rural households in Enugu State, Nigeria. Interview schedule was used to collect data from 91 respondents and data were analyzed by use of descriptive statistics and factor analysis. The mean age of the respondents was 42 years, majority (56%) were male and about 54% married. The mean household size and monthly income of respondents was 6 persons and ₦15, 970 respectively. About 12% had no formal education.. Majority (87.9%) of the respondents had no access to extension services and credit facilities (74.7%). The major system (89%) of exploiting Irvingia gabonensis and Irvingia wombolu is from the wild. Other exploitation systems were: around homestead (85.7%), agroforestry (83.5%), and Irvingia plantations (39.6%). The major benefits of Irvingia products include: condiment/soup thickener (M= 2.80), source of income (M= 2.77), fruit as food (M= 2.63), firewood (M= 2.40), among others. The constraints to exploitation of Irvingia were identified and factorized into production constraints, economic constraints and technological/institutional constraints. Farmers should be educated by extension on how to limit these constraining factors and the need to domesticate Irvingia and appropriate technologies should be transferred to the farmers as this will go a long way to increase productivity.*

Keywords: Exploitation, Farmers, *Irvingia*, Nigeria

Introduction

Non-timber forest products (NTFP) are becoming of great importance (Ike, 2008). *Irvingia* species (bush mango), the source of "ogbono*"* (*Irvingia* kernel) is one of the most important Non-Timber Forest Product (NTFPs) in West and Central Africa especially in Southern Nigeria (Ladipo, 2000). The most important part of *I. gabonensis* to the rural people is its nutritious seeds which have also been found useful in the reduction of cholesterol and body weight in obese patients (Omokhua Ukoima and Aiyeloja., 2012**).** The seeds are popularly used as a condiment (soup thicker) and are responsible for the characteristic appetizing flavour of the Nigeria *ogbono* soup. The leaves and stem bark are employed in the traditional African medicine against fever and stomach-ache (Ekpo, Amor and Morah., 2007). The mesocarp or pulp is consumed locally as a fresh fruit by farming households and as a major source of vitamin C and beta-carotene while environmentalists use the trees as windbreak (Kengni, Kengue ,Ebenezer and Tabuna, 2011).

Bush mango is a valuable source of income for farmers and traders in Nigeria where the fruit is traded locally (Ladipo, 2000). The kernels, which fetch higher price than the fruits are traded regionally and internationally which has given it the potential for a true

Creative Commons User Licence: CC BY-NC-ND
Abstracted by: EBSCO*host*, Electronic Journals Service (EJS), Google Scholar, Directory of Open Access Journals (DOAJ), Journal Seek, Scientific Commons, and Food and Agricultural Organization (FAO)

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

commercial crop, and this has led to more intensive collection in the forests. However, seed extraction is time-consuming and post-harvest losses are high and this limits the potential to increase financial returns (Kengni *et al*., 2011).

Food gathered and hunted in the wild are important, and they will continue to be important in the diet of many forest or farming families in Nigeria (Ladipo, 1996). Predominantly, bush mango is harvested from the wild. However, the high demand situation for bush mango kernels has resulted in excessive exploitation in the bush at such a rate that the sustainability of these natural resources has been the concern of various workers (National Research Council (NRC), 1991) particularly with the continued clearing and selective exploitation of forests (Palmberg, 1984). Demographic pressures on land resources for provision of food to meet the needs of the rising population and a decline in fallow periods have rendered the low-input farming system economically inefficient and ecologically unsustainable. Eneje, (unpublished) noted that farmers are beginning to establish *Irvingia* plantations in outlying farms rather than on compound farms. It is therefore necessary to assess the exploitation of *Irvingia* species among rural households in Enugu State. Specifically, the study examined the exploitation systems of *Irvingia* species; ascertained the benefits of *Irvingia*; and determined constraints to the exploitation of *Irvingia*.

Methodology

The study was carried out in Enugu State, Nigeria. The state is one of the thirty-six (36) states in Nigeria; located between latitude 6.5 (6^0 30'0N) and a longitude of 7.5 (7^0 30'0E); (http://en.wikipedia.org/wiki/Enugustate). The state occupies an area of about 8,022,950KM^2 (Ezike, 1998) and has a population of about 3,257,278 (NPC, 2006). The state has seventeen (17) political Local Government Areas (LGA) and is divided into six (6) agricultural zones namely: Agbani Awgu, Enugu, Enugu-Ezike, Udi and Nsukka. All farmers involved in exploitation of *Irvingia* spp constituted the population for the study.

Two Agricultural Zones (Nsukka and Enugu–Ezike) were purposively selected because of the abundance of *Irvingia* trees in the zones. Simple random sampling technique was used to select three (3) blocks from each of the zones and also four (4) circles from each block, giving a total of 24 circles. Using simple random sampling technique, four (4) farmers were selected from each of the circles giving a total of ninety six (96) respondents for the study. Data were collected using structured interview schedule. However, only ninety one (91) completely filled copies of interview schedule were used for analysis.

The respondents were asked to indicate their perception of benefit derived from *Irvingia* on a 3 point Likert-type scale, using very beneficial (3), beneficial (2), and not beneficial (1). The values on the Likert-type scale were added to get 6, which was divided by 3 to get a mean score of 2.0. Farmers mean score for any variable which is ≥ 2.0 was regarded as a major benefit while mean scores < 2.0 were regarded as minor benefits.

Exploratory factor analysis was employed in grouping the constraint variables into major constraint factors. However, only variables with loading of 0.4 and above (10% overlapping variance), Comrey (1962) were used in naming the factors, while variables that loaded under more than one factor were also discarded. Percentage, mean score and factor analysis was used to present data.

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Results and Discussion

Socio-economic characteristics of the respondents

The mean age of the respondents was 42 years. Majority (56%) of the respondents were male and (53.8%) married. The mean household size was 6 while the mean number of years spent in *Irvingia* farming was 16. About 12% of the respondents had no formal education. The mean monthly income from *Irvingia* farming was ₦15, 970 ($99.74) while the estimated seasonal income was ₦191, 646 ($1197.8). This amount is lower compared to ₦262, 676 ($1640.6) reported by Babalola and Agbeja, (2009) as the seasonal income for *Irvingia* farmers/traders in South West Nigeria. Ntam, Degrande, Asaah (2009) observed that *Irvingia* farmers in Elig Nkouma, Cameroon, earn ₦427, 653 ($2671) in a season.

Creative Commons User Licence: CC BY-NC-ND
Abstracted by: EBSCO*host*, Electronic Journals Service (EJS), Google Scholar, Directory of Open Access Journals (DOAJ), Journal Seek, Scientific Commons, and Food and Agricultural Organization (FAO)

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Table 1: Percentage distribution of respondents based on socioeconomic characteristics

Variable	Percentage	Mean
Sex		
Male	56	
Female	44	
Age (years)		
21-30	28.6	
31-40	20.9	
41-50	25.3	41.93
51-60	18.7	
61 and above	6.6	
Marital status		
Single	31.9	
Married	53.8	
Divorced	2.2	
Widowed	12.1	
Household size		
1- 5	41.8	6.34
6- 10	57.1	
11 and above	1.1	
Years of farming experience		
≥ 10	37.9	
10.1 – 20	42.6	
20.1- 30	12.6	16.44
Above 30	6.9	
Academic qualification		
No formal education	12.1	
Primary education	13.2	
Secondary education	44	
Tertiary education	30.8	
Secondary occupation		
Teaching	11	
Civil service	5.5	
Carpentry	3.3	
Studentship	13.2	
Trading	29.7	
Others	18.6	
None	18.7	
Monthly income		
Less than 21,000	85.7	
21000 – 40000	4.4	
40001 – 6000	4.4	15,970.5
60001- 80000	1.1	
80001 and above	4.4	

Institutional characteristics of the respondents

Access to extension services

Table 2 shows that extension contact was very low as up to 82.1% of the respondents had no extension contact within the last one year. The 17.9% of respondents that had extension contact is far lower than 28% reported in the Red River Delta in Viet Nam by Vu (2007). This may be attributed to several reasons. Firstly, there is increasingly low extension- farmer ratio in Nigeria's extension system (Agbamu, 2011) which could result

to low coverage and inefficiency in service delivery. Also extension outfits in the country particularly the public extension system is constrained by poor funding, logistic support, infrastructural facilities, as well as, administrative bottlenecks. Lack or poor access to extension contact deprives farmers' opportunities of embracing improved technologies/practices and access to useful information in *Irvingia* production. Clark Sunderland , (2004) reported that sustainably harvesting of I. *gabonensis* requires understanding the plant's growth and reproductive characteristics, and applying harvesting practices that permit adequate reproduction or regeneration of plant. Unfortunately, even this basic information is woefully incomplete among farmers. This may be because farmers don't produce Irvingia but harvest from the wild. Definitely, this undermines sustainable growth in *Irvingia* production system.

Membership of social organizations

A greater proportion (70.3%) of the respondents belonged to less than 2 social organizations, 27.5% belonged to 3 - 4 organizations and only 2.2% belonged to 5 organizations and above. The favourable disposition of the respondents to membership of social organizations (58.9%) is not surprising because such institution has proved to be a veritable tool for exploring economy of scale. Farmers could pull their resources together to access production input, information and training requisite for improved productivity. Above all their collective voices are heard and access to external aids improved.

Access to credit facilities

Table 2 further reveals that majority (74.7%) of the respondents did not have access to credit. This situation is unfortunate as farmers need credit in form of input to expand or commercialize their *Irvingia* enterprise. This lack of access to credit facilities may be responsible for the low mean income of the respondents from *Irvingia* and low level of production. The poor access to credit may be due to complexity in the terms of assessing credit. Besides, small scale farmers often lack collateral required for accessing credit from most financial institution. Badiru (2011) reported that the ratio of rural branches to total branches of formal credit institutions is low compared to informal and semi-formal institutions and this constitutes a limitation to small-scale farmers' access to credit in Nigeria.

Access to Irvingia market

About 99% of the respondents agreed to have access to *Irvingia* market. This means that there is adequate market for the product(s) and there was no problem of where to sell and whom to sell to. This is a favorable condition to motivate farmers into the enterprise and importantly sustain small holder families.

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Table 2: Percentage distribution of respondents based on institutional characteristics

Variable	Percentage	Mean
Access to extension services		
Yes	17.9	
No	82.1	
Membership of social organization		
Yes	58.9	
No	41.1	
Number of social organizations belonged to (n= 53)		
>2	70.3	
3 -4	27.5	2.13
5 and above	2.2	
Access to credit facilities		
Yes	25.3	
No	74.7	
Credit sources		
Banks	8.8	
cooperative societies	5.5	
Micro-finance banks	1.1	
Neighbour and relatives	5.5	
Personal savings	79.1	
Access to *Irvingia* market		
Yes	98.8	
No	1.2	

Exploitation system of *Irvingia* species

Table 3 shows that majority (89%) of the respondents harvested *Irvingia* from the wild or communal lands, around homestead (85.7%), agro-forestry (83.5%), and establishment of *Irvingia* plantations (39.6%). The result depicts that *Irvingia* is still regarded as a wild species or forest resource in the study area, a situation which hampers development of the tree and its products. Ladipo, (2000) indicated that less than 10% of the total annual output in Nigeria is harvested from planted trees while the rest is collected from natural forest or from the wild. The sustained supply of *Irvingia* fruits is uncertain as most forest trees have been destroyed as a result of widespread deforestation in Nigeria. Valuable fruit trees such as *Irvingia* should be grown in farmlands and possibly in plantations for more effective management and in order to ensure supply of such fruits in commercial quantities. According to Omokhua *et al*., (2012), the trend in marketing of *I. gabonensis* in Edo State of Nigeria has expanded through bulk buyers and retailers from different parts of Nigeria for the last 15 years. The survey of people involved in the species market profile established the fact that many people are involved from farm gate to urban centres. The income accruing to households from the business of *I. gabonensis* may continue to increase due to increasing demand. Extension should therefore see reasons for increasing the production of this highly valued crop.

Creative Commons User Licence: CC BY-NC-ND
Abstracted by: EBSCO*host*, Electronic Journals Service (EJS), Google Scholar, Directory of Open Access Journals (DOAJ), Journal Seek, Scientific Commons, and Food and Agricultural Organization (FAO)

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Table 3: Percentage distribution of respondents based on system of exploitation if *Irvingia* species

Variable *	Percentage
Establishment of Irvingia plantation	39.6
Agro-forestry	83.5
Around homestead	85.7
Harvesting from the wild	89.0
communal lands	85.7

***Multiple responses**

Benefits derived from *Irvingia*

Major benefits of *Irvingia* products as indicated in Table 4 included: condiment/soup thickener (M= 2.80), source of income (M= 2.77), fruit as food (M= 2.63), firewood (M= 2.40), source of income from fruits (M= 2.56), timber for house construction and carpentry (M= 2.28) and trees for erosion control (M= 2.23). The findings corroborate that of Ayuk Duguma, Franzel, Kengue *et al,* (1999) who reported that the kernel of *Irvingia* is the most important product. They highlighted that it is used for preparing sauces and in making some kind of cake which is highly valued by the people. It constitutes an alternative condiment to okra (*Hibiscus esculentus*), groundnut (*Arachis hypogea*) and *egusi* seeds (*Cucurbita spp*), all three widely used in traditional cuisine in West and Central Africa **(**Kengni *et al.*, 2011). Also, Awono Djouguep Zapfack and Ndoye (2009) in their study opined that the fruits of *Irvingia* are the part mostly used as food, source of income, source of oil, firewood while its bark and leaves is the least used. A small proportion of the farmers indicated some medicinal value associated with *Irvingia* for the treatment of hernia, yellow fever, dysentery, diarrhea and/or anti-poison.

Table 4: Mean distribution of respondents based on benefits derived from Irvingia

Benefit	Mean	STD
Condiment (soup-thickener) for traditional delicacies	2.80*	0.479
Income from the kernels	2.77*	0.424
Food and vitamins from the fruits	2.63*	0.486
Source of income from the fruits	2.56*	0.500
The branches and stem as firewood	2.40*	0.575
The wood for house construction and other carpentry works	2.28*	0.719
Erosion control	2.23*	0.559
Shade fro relaxation or recreation in village center	1.91	0.612
Fruit and leaves as forage for animal nutrition	1.75	0.769
The branches for staking in crop farms	1.74	0.663
Leaves and bark for traditional medicine	1.63	0.778
The trees for marking land boundaries	1.49	0.623
Split shells (dice) for prediction in sorcery	1.46	0.675

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Source: Field work (2013)

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Constraints in the exploitation and marketing of *Irvingia* kernels

The constraints were factorized into production constraints (1), economic constraints (2), and institutional constraints (3). Factors that loaded under production constraints were high production cost (0.745), high pest and rodent attack (0.745), high number of years for vegetative growth before fruiting (0.582). *Irvingia gabonensis* and *I. wombolu* usually reach maturity and begin flowering at 10–15 years of age (Ladipo, Fondoun, Ganga, Leakey *et al*., 1996; Moss 1995). However, much earlier fruiting has been reported, and Ladipo *et al*. (1996) describe trees that produced fruit at six years of age. It has been recognized that if *Irvingia* spp. are to be domesticated and if production is to be increased, then faster and more successful propagation methods are needed. Pest attack, disease and deterioration, contribute to high losses of saleable fruit. This may affect productivity in high quantities. Reports in the *Irvingia* trade indicate that *Irvingia* is a very popular product, which is becoming increasingly scarce as productivity fails to keep up with increasing demand. Agbor (1994) points out, however, that for large-scale production to occur, farmers will need credit to spend on improvements to existing production methods.

Economic and financial constraints (factor 2) include: poor seed germination and long periods of dormancy (0.671), poor/low yielding cultivars (0.606), inadequate finance for plantation agriculture (0.556) and unstable or unguaranteed price for the kernels (0.416). These may be a discouraging factor for commercializing of Irvingia. Omokhua (2012) noted that lack of improved planting materials, absence of credit facilities among others are major limiting factors of production of *I. gabonensis* The inadequate finance may be due to absence of financial institution in the study area as well as lack of collateral to secure loans. Ike (2008) reported inadequate credit as a major/serious constraining factor to *Irvingia* producers in Nsukka**.**

Poor yielding cultivar is a limiting factor as it reduces yield of the crop. According to Leakey (1999), characteristics that farmers would like to see improved in Irvingia production include, fruit quality and yield, earlier maturation of the trees, a longer period of fruit availability and reduced tree height. Okafor (1999) list the desirable characteristics of *I. gabonensis* and *I. wombolu* as fruit size, high fruit yield, good flavor, lack of fibrousness and a shortened time to reproductive maturity.

Variables that loaded under technological/ institutional constraints were: high labour demand (0.659), poor transportation infrastructures (0.635), inadequate extension support (0.571) and availability of close substitutes (0.417). USAID (2005) reported that producers in developing regions often lack access to appropriate inputs and the necessary technical production skills due to inadequate input and credit markets as well as weak extension systems. The absence of an effective, well-trained extension network is a significant constraint to the development of the *Irvingia* industry and the capacity of small producers in particular. Ineffective and inaccessible extension and education networks have resulted in inadequate human technical capacity and expertise in agriculture. Chainsaws, cable wire, and rifles are rather efficient tools in exploiting natural resources. Over the past few decades, these technologies have either been newly introduced, or their use has expanded significantly (Tiayon, Biesbrouck., van den Berg. and Nkoumbele *et al*., 2003). Research and development of *Irvingia* to address production demands of producers is critical to ensure sustainable production systems that will meet market demands in the future. Improving access to extension can help farmers raise productivity and contribute to sound natural resource management.

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

High labour demand is also a limiting factor to increase productivity of *Irvingia* production, because the labour and time involved in harvesting are likely to constrain the number of trees that each farm can maintain (Van Dijk 1999) and this may hinder expansion. However, high labour demands of *Irvingia* production may have the benefit of local employment generation. Per hectare, the production of *Irvingia* may create more than twice the number of jobs that cereal production generates.

Availability of *Irvingia* substitute is another constraining factor as these substitutes may be cheaper than Irvingia. Agbor (1994) points out that, there are local and imported substitutes for *Irvingia* kernels that are currently cheaper. However as long as *Irvingia* can be shown to be a viable competitor in the market in terms of its quality and cost, then larger scale production is possible.

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Table 5: Constraints in the production and exploitation of *Irvingia*

Constraints	Components* 1	2	3
Scarcity and unavailability of land for *Irvingia* plantations	-0.629	0.483	0.204
Poor seed germination and long periods of dormancy	0.143	0.671*	-0.027
Poor/low yielding cultivars	0.150	0.606*	0.108
High labour demand during production	-0.015	-0.040	0.659*
High production costs	0.745*	0.142	-0.080
High number of years for vegetative growth before fruiting	0.582*	0.299	0.370
Negligence and poor official recognition of *Irvingia* by the government	0.623	0.149	-0.417
Poor and inadequate extension support/advisory	-0.117	0.127	0.571*
High pest and rodents infestation of the production and processing sites	0.745*	0.222	-0.234
Poor and inadequate technological resource for harvesting	0.453*	-0.268	0.294
Poor infrastructures to utilize distant farms	-0.169	0.079	0.635*
Inadequate finance for plantation agriculture	-0.024	-0.556*	0.319
Poor storage facilities/short shelf life of the kernels	0.561*	0.308	-0.023
Availability of close substitutes for *ogbono*	0.357	0.219	-0.417*
Transportation/bulky nature of *Irvingia* fruits	0.445	0.433	-0.027
Unstable/unguaranteed price for *ogbono*	0.281	0.416*	0.096

*Factor analysis

Conclusion

Irvingia is still exploited mostly in the wild and it is highly beneficial not only to the farmers but to the whole human race as food, medicine, timber among others. The need for the establishment of pure commercial plantations will help and ensure sustainable production of *Irvingia* in Nigeria. Cultivation and domestication outside of the forest may be the only means to increase economic returns and reduce pressure on wild resources. Extension should focus on *Irvingia* production and education farmers on the importance of domesticating this valued product.

References

Agbor, L.O.N. (1994). *Marketing trends and potentials for Irvingia gabonensis* products in Nigeria. Paper presented at the ICRAF-IITA Conference on *Irvingia gabonensis,* Ibadan, Nigeria. 20th May.

Agbamu, J. U. (2011). Problems and prospects of agricultural extension service in developing countries. In: AESON (ed.). Agricultural Extension in Nigeria. Second edition. Agricultural and Rural Management Training Institute (ARMTI) Iorin.

Awono, A., Djouguep, A., Zapfack, L. and Ndoye, O. (2009). The potential of *Irvingia gabonensis*: Can it contribute to the improvement of the livelihoods of producers in Southern Cameroon? *International Journal of Social Forestry* (IJSF), 2009, 2(1):67-85.

Ayuk, E.T., Duguma, B., Franzel, S., Kengue, J., Mollet, S.M., Tiki-Manga, T. and Zenkekeng, P., (1999). Uses, management and economic potentials *Irvingia gabonensis* in the humid lowlands of Cameroon. *Forest Ecology and Management,* 113: 1-9.

Babalola, F. D. and Agbeja., B.O. (2009). Marketing of *Irvingia spp* (Bush mango) in Southwest Nigeria: prospects and challenges. *Research Journal of Agriculture and Biological Sciences,* 5(6), 944-953

Badiru, I. O. (2011). Review of small farmer access to agricultural credit in Nigeria. Nigeria Strategy support Programme Policy Note No. 25. International Food Policy Research Institute (IFRI).

Clark, L. E. and Sunderland, T. C. H. (2004). The key non-timber forest products of Central Africa: State of the knowledge. *USAID Technical paper* 122.

Comrey, A. L. (1962). The minimum residual method of factor analysis. *Psychological Report*.2:15-18

Ekpo, I. W., Amor, I. D. and Morah, F. N. I. (2007). Seed oils and nutritive studies on the seeds of *gabonensis* and *wombolu* varieties of *Irvingia gabonensis*. *The Nigerian Academic Forum,* 13:1.

Ike, P. C. (2008). Exploratory survey of the production of non-timber forest products for sustainability of livelihoods: The case of *Irvingia* species in Nsukka Agricultural Zone of Enugu State, *Nigeria. Extension Farming Systems Journal* 4:1

Kengni, E., H. (2011). *Irvingia gabonensis*, *Irvingia wombolu*, bush mango. Conservation and sustainable use of genetic resources of priority food tree species in sub-Saharan Africa. *Bioversity International* (Rome, Italy).

Ladipo, D.O., Fondoun, J.M., Ganga, N., Leakey, R..R..B., Temu, A.B., Melnyk, M. and Vantomme. P. (1996). *Domestication of the bush mango (Irvingia spp.): some exploitable intraspecific variations in west and central Africa.* In: In: Leakey, R.R.B., Temu, A.B., Melnyk, M. and Vantomme, P. (eds.) *Domestication and commercialization of non-timber forest products in agroforestry systems*. Proceedings of an international conference held in Nairobi, Kenya, 19–23 February. *Non-Wood Forest Products* 9: 193–205. FAO Rome.

Ladipo, D.O., Fondoun, J.M. and Gana, N. (1996). Domestication of the bush mango (*Irvingia spp*): Some exploitable intra-specific variation in West and Central Africa. In: Leakey, R.R.B., Temu, A.B., Melnyk, M. and Vantomme, P. (eds.) *Domestication and commercialization of non-timber forest products for agroforestry*. Non-Timber Forest Products Paper 9, FAO Rome. 193-206.

Ladipo, D.O. (2000). Harvesting of *Irvingia gabonensis* and *Irvingia wombolu* in Nigerian forests: Potentials for the development of sustainable systems. Paper presented at the seminar harvesting of non-wood forest products, held at Menemen-Izmir, Turkey. Available at http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/Y4496E/Y4496E32.htm.

Leakey, R. R. B. (1999). Potential for novel food products from agroforestry trees: a review. *Food Chemistry* 66 (1): 1–14.

Journal of Agricultural Extension
Vol.18 (2) December, 2014
ISSN 1119-944X
http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae

Moss, R. (1995). Underexploited tree crops: components of productive and more sustainable farming systems. *Journal for Farming Systems Research-Extension* 5 (1): 107–117.

National Research Council (NRC) (1991). Managing global genetic resources: forest trees. National Academy Press. Washington DC. p 228.

NPC (2006). National Population of Nigeria Population Figures, NPC, *published bulletin*, Enugu.

Ntam, F., Degrande, A., Asaah, E.K. (2009). Indigenous fruit trees and their contribution to household income: case of Dacroydes edulis and Irvingia gabonensis in Elig Nkouma, Cameroon, World Agroforestry Centre (ICRAF), West and Central Africa; Yaounde, Cameroon. 2009. 1p

Okafor, J.C. (1999). The use of farmer knowledge in non-wood forest product research. In T.C.H. Sunderland, L.E. Clark & P. Vantomme (eds.). *Non-wood forest products of Central Africa:*

Omokhua, G.E, Ukoima, H.N. and Aiyeloja, A.A. (2012). Fruits and seeds production of *Irvingia gabonensis* (O' Rorke) and its economic importance in Edo Central, Nigeria. *Journal of Agriculture and Social Research* (JASR) 12 (1), 149-155.

Tiayon, F.F., Biesbrouck. K., van den Berg, J. and Nkoumbele, F. (2003). Social change exploitation and management of natural resources in the Bipindi-Akom II Area. Sustainable management of African rain forest.

USAID (2005). Global horticultural assessment. The world vegetable center. June. Available http://pdf.usaid.gov/pdf_docs/pnadh769.pdf. Accessed 26/12/12.

Van Dijk., J.F.W. (1999). An assessment of non-wood forest product resources for the development of sustainable commercial extraction. In T.C.H. Sunderland, L.E. Clark & P. Vantomme *Africa: current research issues and prospects for conservation and development*. Rome: Food and Agriculture Organisation,. 37–50.

Vu, L.H. (2007). Efficiency of rice farming households in Vietnam: A DEA with Bootstrap and Stochastic Frontier Application Preliminary Draft. Available http://www.cid.harvard.edu/neudc07/docs/neudc07_poster_vu.pdf. Accessed 12/02/13.