Assessment of Early Growth Rate of *Moringa oleifera* (Lam) Seedlings on different Soil Medium in University of Agriculture, Makurdi-Nigeria

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Abstract*Nigerian Journal of Forestry Vol. 45 Nos 1 & 2 (www.njf-ng.org)*

Moringa oleifera (Lam) is an important multipurpose tree species that is used in Nigeria. The tree species contributes greatly to food security and serve as a source of income to the rural dwellers. The rate of production and yield of the plant is very low and do not meet the ever growing demand for human and animal consumptions. As a solution to solve this problem in Makurdi; the study was conducted with the aim to assess the effect of distinctive soil media on seed germination and the growth performance of *M. oleifera (Lam)* seedlings at the Forestry department nursery site in South-core, University of Agriculture, Makurdi. The distinctive soil media were top soil, river sand and composite manure (treatment A); top soil, river sand and poultry manure (treatment B) and top soil and river sand (treatment C) served as a control. *M. oleifera (Lam)* seeds were planted in 240 polythene bags and replicated four times. The media were laid in completely randomized design. Daily germination rate records of seedlings were observed in every 3days for 15 days after sowing; and stem height, number of leaves, leaf width and leaf length were recorded in an interval of 10days for four weeks. Data were subjected to ANOVA; results showed that there were significant differences ($p < 0.05$) among the treatments in terms of seedlings height, leaflets width and length, and leaflet numbers. The results in treatment C demonstrated better growth potential, than seeds planted in treatment A and B, respectively. Sustainable production of *moringa* seedlings could be achieved by adopting soil potting mixture of topsoil and river sand.

Key words: Germination, *M. oleifera* (lam), Seedlings, Media/medium, Parameters

Introduction

*Moringa oleifera*is a plant which belongs to the moringaceae family; the generic nameis derived from the Tamil word *"Murunggai"*or the *Malayalam* word "Moringa" both of which refer to *M. oleifera.* It is known by several names in different countries, but is popularly called the "Moringa tree" or "miracle tree" (in Nigeria). It is one of the important traditional multipurpose food plants that is produced and used in many African countries (Amaglo, 2007; William *et al*., 2012). *M. oleifera (Lam)* is a multipurpose tree with great potential to become one of the most economically important crops in developing countries because of its socio-economic importance in many fields in the life of human and animals (Fugli, 2001).

M. oleifera is one of the world's most nutritious crops and fast-growing tree that are grown throughout the tropics for different purposes such as forage, medicine, dye, and water purification (Palada and Chang, 2003). The tree species is extensively used in alley cropping systems; the leaves are used for feeding fish in Aquaculture (William *et al*., (2012). M*oringa* tree species shows the potential to curb the shortage of feeds for livestock; its leaves are readily eaten by animals (such as cattle, sheep goats, pigs and rabbits).

This fast-growing shrub has recently been identified by the World Vegetable Centre as a vegetable with the highest nutritional value among 120 food species (Claudette and Pierre, 2014). The fresh leaves of *M. oleifera* are seven times richer in vitamin C than oranges. Similarly, they are four times richer in vitamin A than carrots, have as much protein as eggs and are four times richer in calcium than milk. They triple bananas in potassium (Palada and Chang, 2003; Nancy, 2004; Claudette and Pierre, 2014).

Several parts of the plant are also used in native medicines and folk remedies for the treatment of ear, eye and bronchial complaints, skin infections, fevers, stomach ulcers, diarrhea, syphilis and nervous

disorders (Ecoport, 2007). For example, the flowers are used to cure inflammations, the pods are used for joint pain, the roots are used to treat rheumatism, and the bark can be chewed as a digestive (Papillo, 2006). It has also been widely described as having antibiotic properties and being a cancer preventative (Fahey, 2005). The plant seeds are used as a sexual virility drug for treating erectile dysfunction in men and also in women for prolonging sexual activity (Lea, 2010).

The leaves also provide excellent materials for the production of biogas (Kivevele *et. al..*, 2011). The seed oil which is known as "Ben oil" is used as a lubricant for industrial machinery in some European countries (William *et al*., 2012). *M. oleifera* also provides nectar to honey bees for a long period of the year (HDRA, 2002; ICRAF, 2001). It is particularly desirable because it is a very low water-use crop and may be cultivated on marginal land i.e. in semi-arid areas, on poor soils and in saline areas (Brockman, 2007; SWCC, 2007).

Much work has not been carried out on *M. oleifera* cultivation at nursery stage in term of its germination, growth and productivity using the different types of organic manure commonly available in the different geographical zones of Benue state in Nigeria. Sequel to this problem; this study was carried out to assess the suitable soil medium for growing *M. oleifera* seedlings for possible plantation establishment in Makurdi-Nigeria.

Materials and methods

The Study Area

The experiment was carried out at Forestry Department nursery, located atsouth-core, University of Agriculture Makurdi (UAM). University of Agriculture Makurdi lies between longitude 8° 21' and 9° E and latitude 7° 21' and 8° N in Benue State (in the southern guinea savanna ecological zone). One important feature is the presence of the River Benue which divides the town into the northern and southern parts. The climate of the area is tropical sub-humid with high temperatures and high humidity. The average maximum and minimum daily temperature of 35° C and 21° C in wet season, and 37° C and 16° C in dry season. Benue state has boundaries to the south with Enugu and Cross River states, to the east with Taraba state, north with Nasarawa state and west with Kogi state. The climate is characterized by distinct rainy and dry seasons. The mean annual rainfall value is between 1200mm to 1500mm. The vegetation of the area has been described as Southern guinea savanna (UAM Physical Planning Manual, 1989). The major occupations of the people include; farming, civil service, trading and hunting; and the major tribes found are *Tiv*, *Idoma* and *Igede.*

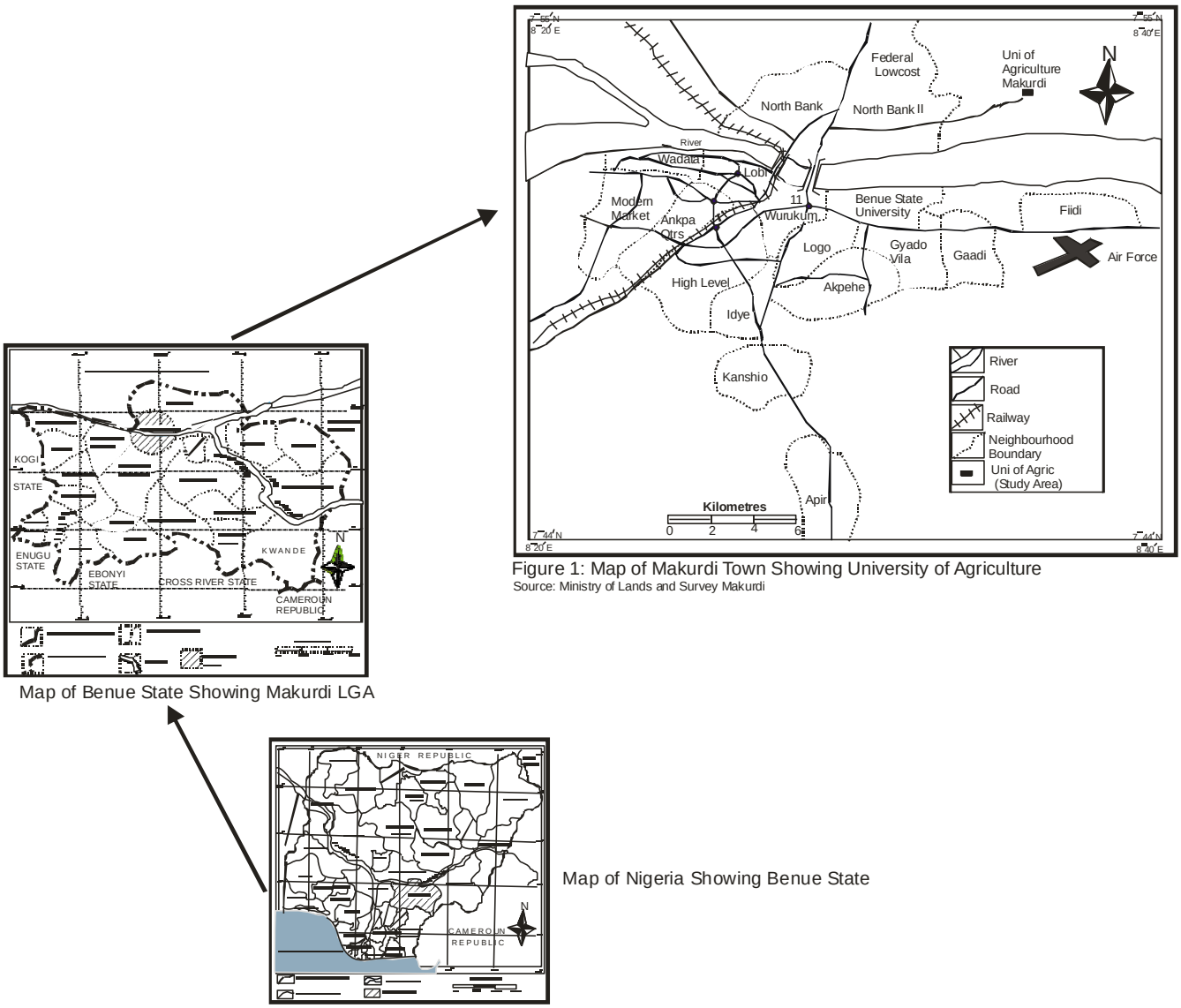

Figure 1: Map of Makurdi Town Showing University of Agriculture
Source: Ministry of Lands and Survey Makurdi

Map of Benue State Showing Makurdi LGA

Map of Nigeria Showing Benue State

Figure 1: Map of the study Area

Experimental design, Data collection and Analysis

Moringa oleifera pods were collected from matured trees within the study area in Makurdi local Government Area of Benue State by the used of long stick. Pods were sun-dried for four (4) days before being crushed manually with hand to extract seeds. A total of two hundred and forty (240) black polythene bags of size 18 cm x 12 cm were each perforated with four holes at the bottom to facilitate drainage. The polythene bags were filled with thoroughly mixed soil of different treatments as planting medium. Viable seeds were planted directly into the polythene bags containing the different treatments. The seedlings were watered daily for the first month, every two days for the second month (William *et al.*, 2012).

The experimental design was Completely Randomized Design (C.R.D) in four replications. The experiment consisted of three treatment combinations as follows - i. Topsoil, River sand and compost manure (the compost was made up of decayed debris/waste bins) in the ratios of 2:1:1 (Treatment A); ii. Topsoil, River sand and decomposed Poultry dung manure in the ratio 2:1:1 (Treatment B) and iii. Control -Topsoil and River sand in the ratio 2:1 (Treatment C).

Emergence was monitored daily from the 5th to 15thday until emergence ceased. Germination rate was observed at the interval of 3 days for 15 days. The Seedling parameters data on leaf number, width and length of leaflets and seedling height were recorded at intervals of 10days for the period of two

months. The stem height was measured using a measuring tape from the collar region (base) of each seedling to the terminal leaf; while the number of leaves on each seedling was recorded by manual counting. These assessments represented the germination rates for the three growth media of *M. oleifera (LAM).*Data collected from the seedlings of *M. oleifera* at nursery stage were subjected to analysis of variance (ANOVA) using SPSS version 16.00 and the Duncan multiple range (P<0.05) were used to separate the means between the treatments and the results were presented on tables and chart.

Results and discussion

Effects of Potting Mixture on Germination Rates in Makurdi-Nigeria

The results on germination rate is shown in table 1; it showed that for the first 5th days there was no germination among the studied treatments. This may be attributed to the fact that sufficient water imbibition had not yet fully taken place for the embryo to resume growth. Germination commenced on the 7th day in treatments A and C. On the fifteenth (15th) day, treatment C had the highest germination percentage of 94.6%. Treatment A had 9.5% germination and treatment B had 80% germination, respectively.

The germination rate was not significantly different between treatment A and C but there was a significant difference between treatment B and C. Therefore, treatment C as control (topsoil and river sand) performed well and better than treatment A (topsoil, river sand &composite manure) and treatment B (topsoil, river sand and decomposed poultry manure). This result is in accord with that of Jahn *et al.*, 1986; Nautiyah and Venhataraman, 1987; Parrota, 19), who reported that 'it takes 7-30 days for the seed of *Moringa oleifera (LAM)* to germinate, depending on the environmental temperature of an area. Annerber (2009) reported that germination will occur within 5-12 days, depending on the age of the seed and pre-treatment method used. Therefore, plant seedlings in Treatment C (mixed soils of Topsoil & River sand in the ratio of 2:1) appeared healthy and vigorous; this result disagreed with William et al., (2012) who reported that control was the lowest with germination rate when they compare the soil amendments (media). The effects of potting mixtures assessment on seedlings leaflet number were presented in table 1. It showed the mean leaflets number of seedlings observed through counting at three different dates for the different potting mixtures. The table indicated that soil potting mixtures showed no significant difference (P>0.05) in all the treatments at day 10th (F=0.38, P=0.67 P>0.05) and 20th (F=0.66, P=0.54 P>0.05) respectively after germination. There was significant difference on the leaflet numbers (F=3.55, P=0.02 P>0.05) on 30th day of assessment.

Control thrift better than the other treatments under studied as showed on the Table 1. This finding disagreed with the report of William et al., (2012), they stated that composite potting mixture recorded the highest number of leaves in all the three harvesting regimes.

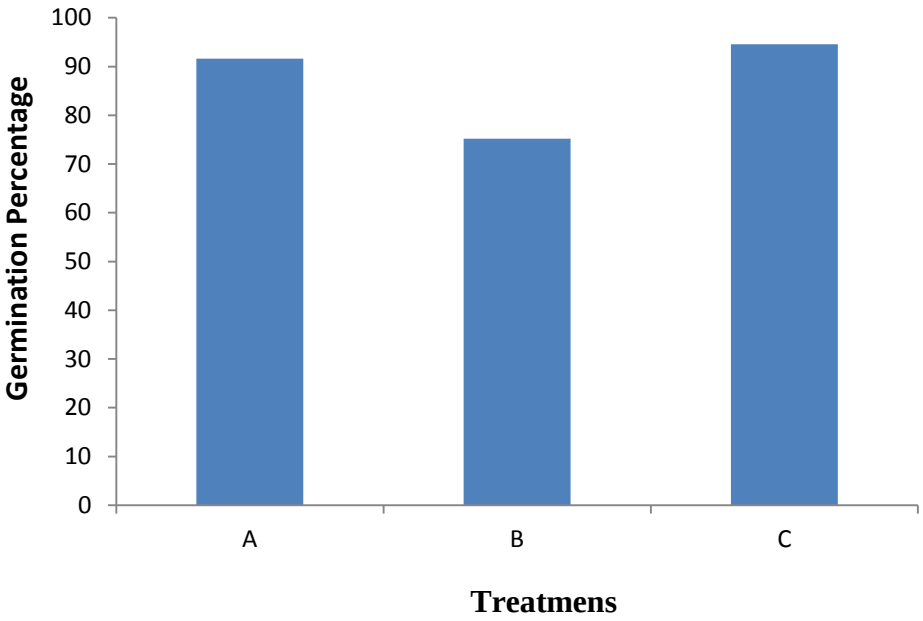

Figure 2: *M. oleifera* Germination Rate from Different potting Mixture (treatments) (%)

Table 1: Effects of Potting Mixture on Mean Leaflets Number of *M. oleifera* Seedlings at Nursery Stage in Makurdi, Nigeria

Treatment	Mean Leaflet number by Date of Assessment		
	Day 10th	Day 20th	Day 30th
A	3.32 ±0.16 a	5.70 ±0.16 a	7.35 ±0.29 a
B	3.20 ±0.21 a	5.55 ±0.23 a	6.60 ±0.31 a b
C	3.35 ±0.20 a	5.80 ±0.29 a	7.75 ±0.33 b

Mean values with same alphabets are not significantly different from each other. P≤ 0.05

The results on Table 2 showed the effects of potting mixtures on seedlings height (cm) of this species at three (3) different dates of assessment. Soil potting mixture showed a significant difference ($p<0.05$) at 8th week after germination in stem height. There was no significant difference ($p>0.05$) in stem height at day 20th (4 weeks after germination). Treatment C (topsoil & River sand) had the highest mean seedling height in all three different dates assessed (14.55, 21.50 & 27.46) followed by treatment A(topsoil, river sand & composite manure) which had 14.30, 20.84 & 26.00 while treatment B (topsoil, river sand & poultry dung manure) had the least height with 11.25cm,17.75cm and 22.60cm taken three times at the interval of 10 days respectively. The result showed significant difference ($F=4.66$, $P=0.01$ $P<0.05$) in parameters assessed on the 10th day but on the 20th day, there was no significant variation ($F=1.4$, $P=0.33$ $P>0.05$) in height of the seedlings in all the three media; while on 30th day, there was significant variation ($F=4.42$, $P=0.04$ $P<0.05$) among the three treatments in terms of height (cm).

This result is in accord with the work of (Annenberg, 2009; Fuglie, 1999), who reported differently that "the soil mixture for the *M. oleifera* should be light, which is 3 parts of soil to 1 part sand. This finding is not in accord with Imoro*et al.*, (2012), who reported that 'the shoot height of seedlings treated with decomposed poultry manure (treatment C) produced the highest length compared to those other treatments and controls (treatment C); also, William et al., (2012), who reported that after germination, Composite manure and soil recorded the highest stem height value followed by Rice husk.

Table 2: Effects of Soil Mixture on *M. oleifera (LAM)* Seedlings Height at different Dates in Makurdi, Nigeria

Treatment	Seedling height by Date of Assessment (cm)		
	Day 10th	Day 20th	Day 30th
	14.30 ±0.69 a	20.84 ±0.54 a	26.00 ±0.55 a
B	11.25 ±1.08 b	17.75 ±1.52 a	22.60 ±1.32 a b
C	14.55 ±0.78 b	21.50 ±1.15 a	27.46 ±1.34 b

Mean values with same alphabets are not significantly different from each other. P≤ 0.05

Table 3: Mean Width of *Moringaoleifera* (LAM) Leaflets at three Different Dates in Makurdi-Nigeria

Treatment	Mean Width of Seedlings by Date of Assessment		
	Day10th	Day 20th	Day 30th
A	2.34 ±0.13 a	2.45 ±0.10 a	2.54 ±0.14 a
B	2.35 ±0.14 a	2.60 ±0.11 a	2.18 ±0.14 a
C	2.95 ±0.18 a	2.86 ±0.16 a	2.77 ±0.10 b

Mean values with same alphabets are not significantly different from each other. P<_ 0.05

Table 3 shows the mean width of *M. oleifera* (Lam) leaflets (cm) taken at three (3) different dates. Treatment C (topsoil & River sand) had the highest mean length at three different dates. ANOVA test on the width leaflets showed no significant difference in the widths among the potting mixtures/treatments (F=0.59, P=0.48 P>0.05) on the 10th day and 20th day (F=0.79, P=0.42 P>0.05) while there was significant difference (F=6.5, P=0.04 P<0.05) on 30th day in treatments C, which significantly different with treatments A and B but no significant difference between treatments A and B.

Table 4: Effects of Potting Mixture on *M. oleifera* Leaflet Length at three Different Dates in Makurdi, Nigeria

	Length of leaflets by Date of collection (cm)		
Treatment		Day 10th	Day 20thDay 30th
A	2.65 ±0.12 a	2.80 ±0.13 a	3.25 ±0.13 a
B	2.60 ±1.17 a	2.75 ±0.12 a	3.05 ±0.11 a
C	2.80 ±0.19 a	2.95 ±0.15 a	3.75 ±0.09 b

Mean values with same alphabets are not significantly different from each other. P≤ 0.05

Effects of potting mixture on *M. oleifera* leaflet length at three different dates are shown on Table 4. The mean length of *M. oleifera (LAM)* seedling leaflets (cm) was assessed from the different treatments at 3 different dates. Treatment C (topsoil and River sand) had the highest mean length at three different time intervals (Table 3). The finding on the seedling leaflet lengths showed no significant difference (F=0.56, P=0.42 P>0.05) on the 10th day and 20th day (F=0.66, P=0.47 P>0.05) in all the treatments (A, B and C) but there was significant difference in the length of leaflets (F=1.02, P=0.37 P>0.05) on 30th day among the treatments (A, B and C).According to this finding, seedlings of *M. oleifera(Lam)* do better in potting mixtures prepared for sand and topsoil (Treatment C). This result is in accord with Amaglo (2007), who reported that "*M. oleifera (LAM)* prefers a well-drained sandy loam or loamy soils".

Conclusions and Recommendation

Based on the results obtained, *M. oleifera (Lam)* seeds had high germination rate and low mortality rates at nursery stage. Thus, soil mixture ratio of 2:1 treatment (topsoil and river sand) gives the highest germination percentage rate of 94.6%. The results obtained on early

growth rate revealed that treatment C (topsoil and river sand) was the best for all the parameters measured especially at the 30thday (8th weeks) after planted. For a successful high germination and fast growth of Moringa seedling at early stage, it is evident that *M. oleifera* (Lam) thrives well when raised in treatment C - a soil mixture of topsoil and river sand in ratio 2:1. It is therefore, recommend that *M. oleifera* plantation establishment should be encourage, since the tree species contributes greatly to food security and serve as means of income generation among the rural dwellers in Nigeria.

References

Amaglo N.K.(2006): Workshop 2; How to Produce Moringa Leaves Efficiently? (Anglophone group), *Kwame Nkrumah University of Science and Technology, Ghana*

Amaglo, N.K. (2006): Effects of Spacing and Harvest Frequency on the Growth and Leave Yield of Moriga (*Moringa oleifera* Lam), a Leafy Vegetable Crop. Masters' Thesis. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Annenberg F. (2009, ed.): Cultivation of Moringaoleifera- Easy instructions adapted from Lowell J. Fuglie and K. V. Sreeja

Brockman H. (2007): Production of Biodiesel from Perennials; Western Australian Department of Agriculture and Food, Albany, Western Australia.

EcoPort (2007): *Moringa oleifera*; Full Record; http://ecoport.org/ep?Plant=2348&entityType=PL&entityDisplayCategory=full. EcoPort Foundation.

Fahey, J.W (2005): *Moringa oleifera*: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties, Part 1; Trees For Life Journal: a forum on beneficial trees and plants 1:5. http://www.tfljournal.org.

Fuglie L.J. (1999): The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. Church World Service, Dakar. 68 pp.; revised in 2001 and published as The Miracle Tree: The Multiple Attributes of Moringa, 172 pp.

Fuglie L.J. (2001a): New Uses of Moringa Studied in Nicaragua. ECHO Development Notes #68, June, 2000.

Fuglie, L J., (2001b): Combattre la malnutrition avec le Moringa *in* L'arbre de la vie, Les multiples usages du Moringa. CTA et CWS, Dakar, pp.119 à 139.

HDRA (2002): *Moringa oleifera*: a multi-purpose tree. http://www.gardenorganic.org.uk/pdfs/international_programme/Moringa.pdf. HDRA–the Organic Organization. Coventry, UK.

ICRAF (2001): Agroforestry tree (AFT) Database. The ICRAF Agroforestry Tree Database.<http://www.icraf.cgiar.org/Sites/TreeDBS/aft.asp>.World Agroforestry Centre (ICRAF), Nairobi, Kenya.

Imoro, A-W.;Sackey, M. I. and Abubakari, A-H. (2012): Preliminary Study on the Effects of Two Different Sources of Organic Manure on the Growth Performance of *Moringa oleifera* Seedlings; *Journal of Biology, Agriculture and Healthcare* www.iiste.org ISSN 2224-3208 (Paper) ISSN 2225-093X (Online) Vol 2, No.10, 2012.

Jahn, S. A.; Musnad, H. A. and Burgstaller, H. (1986): The tree that purifies water: cultivating multipurpose Moringaceae in the Sudan. Unasylva38, 2, 23–28.

Kivevele, T.T.; Mbarawa, M.M.; Bereczky, A. and Zöldy M. (2011): Evaluation of the oxidation stability of biodiesel produced from *Moringa oleifera* oil. *Energy Fuels 25(11):5416-5421*.

Lea M. (2010): *Bioremediation of Turbid Surface Water Using Seed Extract from Moringa oleifera Lam. (Drumstick)Tree*.

N. P. C. (National Population Commission, 2006): Federal government of Nigeria gazette.

Nautiyah, B. P. and Venhataraman, K. G., (1987): Moringa (Drumstick) – an ideal tree for social forestry. Myforest23, 1, 53–58.

Palada MC, and LC Chang, (2003): Suggested cultivation practices for Moringa. AVRDC Publication #03-545; http://www.avrdc.org/LC/indigenous/moringa.pdf

Papillo, J., (2007): *Moringa oleifera*: the multipurpose wonder-tree; http://peacecorps.mtu.edu/resources/studentpro

jects/moringa.htm; Michigan Technological University, Michigan, USA.

Parrotta, J. A., (1993): *Moringa oleifera* Lam. Reseda, horseradish tree; Res. Note SO-ITF SM-61, South; For. Res. Sta., For. Serv., U.S. Dep. Agric., New Orleans, LA, USA.

SWCC, (2007): South West Catchments Council, Annual Report 2005/2006; South West Catchments Council, Bunbury, Western Australia.

University of Agriculture Makurdi (UAM) Physical Planning Manual, 1989

Verdcourt, B., (1985): A synopsis of the Moringaceae. *Kew Bulletin* 40: 1–23.

Von-Maydell H.J.(1986):Trees & Shrubs of the Sahel, their Characteristics &uses. Deutsche Geselischaft (GST) Germany, pp334-337.

William, J.A.; Kwame O. B. and Baatuuwie, N. B. (2012): Initial growth response of *Moringa oleifera* seedlings to different soil amendments; *African Journal of Agricultural Research Vol. 7(45), pp. 6082-6086*.