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ASSESSMENT ON THE EFFECTS OF POTTING MIXTURES ON GERMINATION AND GROWTH OF *MORINGA OLEIFERA* (LAM) SEEDLINGS IN SUDAN SAVANNA ECOLOGY ZONE OF NIGERIA

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ABSTRACT

This study was carried out in the Forestry nursery, Audu Bako College of Agriculture Dambatta, Kano-Nigeria. The aim was to evaluate seed germination and the growth rates of Moringa oleifera (Lam) in three (3) different growth media; to determine the best growth medium to raise Moringa seedlings; and to determine which of the growth medium support vigorous and early growth for Plantation establishment in Sudan savanna ecology of Nigeria. The different soil media were: top soil, river sand and cow dung manure (treatment A); top soil, river sand and poultry manure (treatment B) and top soil and river sand (treatment C). Seeds of M. oleifera(Lam) tested for viability by floatation method were planted in different soil Media and replicated three times. The experiment was arranged in a Completely Randomized Design and watering was carried in all the treatments daily. The germination and growth of the seedlings were assessed for twelve weeks. Parameters measured were: germination rates, seedlings height, leaflets width and length, and leaflet numbers. Data were subjected to ANOVA and results showed that there was significant difference on parameters assessed on the 10th day (F=4.56, P=0.01 P<0.05) and 30th day (F=3.42, P=0.04 P<0.05) among the three treatments in terms of height (cm) but on the 20th day, there was no significant variation (F=1.02, P=0.37 P>0.05) in height of the seedlings among the treatments. Therefore, germination and early growth rate of Moringa oleifera seeds in treatment C (topsoil & river sand) demonstrated better growth potential on the average, than seeds planted in treatment A and B, respectively.

Key words: *Germination; Moringa oleifera (lam); Treatment; Seedlings; Media/medium; Parameters*

INTRODUCTION

Moringa is the sole genus in the flowering plant family Moringaceae belonging to the plant; Order Brassicales, Gnus Moringa and Specie *oleifera* Lam. Thirteen (13) varieties/species are known within the species *oleifera* (Verdcourt, 1985). The generic name–is derived from the Tamil word *"Murunggai"*or the *Malayalam* word "Moringa" both of which refer to *Moringa oleifera.* It is known by several names in different countries, but is popularly called the "Moringa tree" or by vernacular name as Zogale in Hausa (in Nigeria). It is also known as "miracle tree" for the multi-purpose uses (Von-maydell, 1986). It is one of the important traditional multipurpose food plants that is produced and used in many African countries (William *et al*., 2012).

According to Fuglie, (1999), Moringa plant can be a source of high quality food for both humans and animals. It is one of the world's most nutritious crops and fast-growing tree that is grown throughout the tropics for purposes such as forage, medicine, dye, and water purification (Palada and Chang, 2003). The leaves of

Moringa have more beta-carotene than carrots, more protein than peas, more vitamin C than oranges, more calcium than milk, more potassium than bananas, and more iron than spinach. Its leaves are readily eaten by animals (cattle, sheep goats, pigs and rabbits); it is also used for feeding fish in Aquaculture;–crushed leaves are used in some parts of the world to scrub cooking utensil or to clean walls (William *et al.,* 2012).

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 juice extracted from the leaves can be used to make foliar nutrient capable of increasing crop yield by up to 30% (William *et al*., 2012). The seed oil which is known as "Ben oil" is used as a lubricant for industrial machinery in some European countries. *Moringa 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).

Moringa oleifera, as an economic tree plant often grown in the northern part of Nigeria as a boundary or fence in farmlands. It is also as a backyard tree to meet the ever growing demand for human and animal consumption. This study was initiated to determine the most suitable soil medium for growing Moringa oleifera seedlings for possible plantation establishment in Kano-Nigeria. However, not much work has been done on its cultivation at nursery stage with respect to its germination, growth and productivity using the different types of organic manure commonly available especially in the different geographical zones of Nigeria.

MATERIALS AND METHODS

The Study Area

The experiment was carried out in the forestry nursery, department of Forestry technology, Audu Bako College of Agriculture Kano-Nigeria. The study area lies between latitude 12^{o} 25' to 12^{o} 40' N and longitude 8^{o} 35' N to 8^{o} 45' E. It is located in the Sudan savanna ecology zone of Nigeria. Hausa and Fulani, who are predominantly Muslims, inhabit Kano State. Kano State has a population of about 9, 383, 682 (NPC, 2006). It has 44 local governments, with an area of 20,479.6 square kilometer. Kano State lies within the Sudan Savanna vegetation zone. The annual rainfall is between 800mm - 1000 mm in the northern part and increases to 1,120mm in the southern part of the state. The rainy season lasts within the months of May to October.

Experimental design and Data collection

Moringa oleifera (Lam) pods were collected from matured trees in Dambatta irrigation farming zone by climbing and plucking from the mother tree. Pods were sun-dried for two (2) days before being crushed manually with hand to extract seeds. The seeds were subjected to viability test by floatation method before planting. A total of three hundred and sixty (360) 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 and were monitored daily with watering two times daily until germination started. The seedlings were subjected to the same watering regime throughout the experimental period.

The experimental design was Completely Randomized Design (C.R.D) in three replicates with three treatments as follows: - i. Topsoil, River sand and decomposed Cow dung manure in the ratio 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).

As the plumule emerged, emergence was monitored daily from the 5th to 15th day until emergence ceased. Seedling parameters of interest include: Germination rates, width and length of leaflets and seedlings height and leaflets numbers were measured using a ruler/grid sheet. Observations were recorded at intervals of 10days for the period of one month. All germinated seedlings from each treatment were assessed. The assessments represented the germination rates for the three growth media of *M. oleifera (LAM).* Germination percentage, mean and standard deviations (S.D) were determined and subjected to Analysis of Variance (ANOVA) and the results were presented on tables and charts for clarity.

RESULTS AND DISCUSSION

Germination

The results of germination tests is shown in table 1 and indicated that for the first 6th days there was no germination. This may be attributed to the fact that sufficient water imbibitions had not yet fully taken place for the embryo to resume growth. Germination commenced on the 7th day for both treatments A and C without any germination in treatment B. On the fifteenth (15th) day, treatment C had the highest germination percentage of 92.5. Treatment A had 90% germination and treatment B had 70% germination, respectively.

The germination percentage 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 treatments A (topsoil, river sand & decomposed cow dung manure) and 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, 1993), 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. Thus, plant seedlings in Treatment C (mixed soils of Topsoil & River sand in the ratio of 2:1) appeared healthy and vigorous.

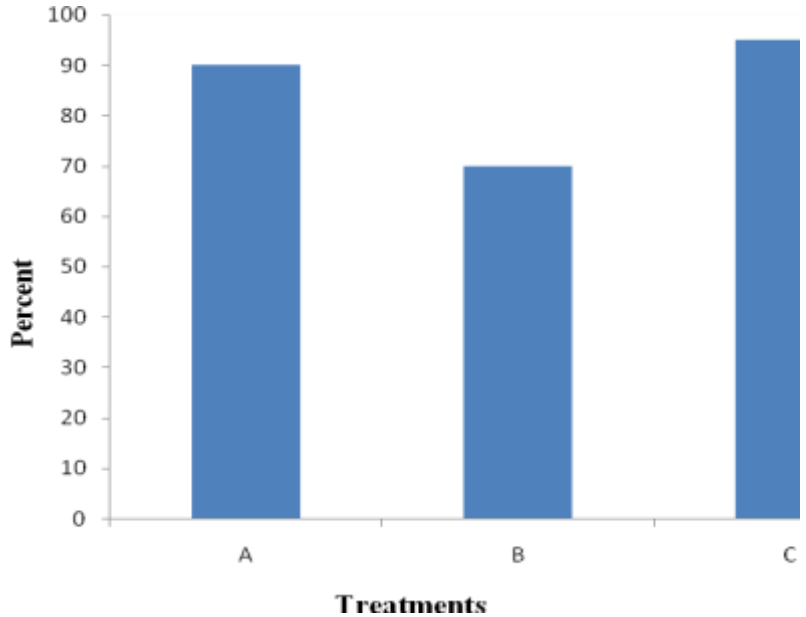

Figure 1: Germination Rates of *Moringa oleifera* (Lam) from Different Treatments (%)

Table 1 shows the mean seedlings height (cm) of *Moringa oleifera (Lam)* treatments at three (3) different assessments days. Treatment C (topsoil & River sand) had the highest mean seedling height for all three different assessments days in the study area (13.51, 20.00 and 26.36) followed by treatment A(topsoil, river sand & cow dung manure) which had 10.25, 19.80 & 24.00 while treatment B (topsoil, river sand & poultry dung manure) had the least height with 13.15cm,17.92cm and 22.84cm taken on the 10th day, 20th day and 30th day, respectively. The Analysis of Variance results showed significant difference in parameters assessed on the 10th day (F=4.56, P=0.01 P<0.05) and 30th day (F=3.42, P=0.04 P<0.05) while on the 20th day, there was no significant variation (F=1.02, P=0.37 P>0.05) in height of the seedlings among the three media.

Table 1: Analysis of Variance test of *Moringa oleifera (LAM)* seedlings Height at different Dates in Sudan Ecology Zone of Nigeria

Treatment	**Seedling height by Date of Assessment (cm)**		
	Day 10th	**Day 20th**	**Day 30th**
A	10.25 ±0.69 a	19.80 ±0.54 a	24.00 ±0.54 a
B	13.15 ±1.08 b	17.92 ±1.51 a	22.84 ±1.33 a b
C	13.51 ±0.78 b	20.00 ±1.12 a	26.36 ±1.33 b

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

This result disagreed 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 treated with decomposed cow dung manure (treatment B) and controls (treatment C) respectively. Seedlings treated with cow dung manure also out- performed the controls in terms of plant height. This result is in accord with the work of Annenberg (2009) and Fuglie (1999), who reported that "the soil mixture for the *moringa oleifera* should be light, which is 3 parts of soil to 1 part of river sand.

Table 2 shows the mean length of Leaflets (cm) of *Moringa oleifera (LAM)* treatments that was assessed at 3 different times in the study area. Treatment C (topsoil and River sand) had the highest means length at three different times (1.95cm, 2.89 cm and 2.72cm). Result obtained on seedlings height showed no significant difference (F=0.66, P=0.52 P>0.05) on the 10th and 20th days (F=0.76, P=0.47 P>0.05) among the treatments A, B and C. While 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). Therefore, seeds of *Moringa oleifera* sprouted, germinated and grew better in potting mixtures prepared for sand and topsoil (Treatment C). This finding is in accord with Amaglo (2006), who reported that "*Moringa oleifera (LAM)* prefers a well drained sandy loam or loamy soils".

Table 2: Leaflets Length of *Moringa oleifera (Lam)* Assessed at Different Dates in Sudan Ecology Zone of Nigeria

	Length of leaflets by Date of collection (cm)		
Treatment	**Day 10th**	**Day 20th**	**Day 30th**
A	1.68 ±0.13 a	1.89 ±0.13 a	2.18 ±0.13 a
B	1.78 ±1.18 a	1.87 ±0.12 a	2.27 ±0.11 a
C	1.95 ±0.19 a	2.89 ±0.15 a	2.72 ±0.09 b

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

Table 3 shows the mean leaflets width of *M. oleifera* (cm) assessed at three different dates. Treatment C (topsoil & River sand) had the highest mean leaflets length during the period of the study. The test results on leaflets width showed no significant difference among the treatments on 10th day (F=0.56, P=0.58 P>0.05) and 20th day (F=0.79, P=0.46 P>0.05). While on

30th day there was significant difference (F=5.6, P=0.01 P<0.05) in treatments C, which significantly differ from treatments A and B. Treatments A and B leaflets width did not significantly differ according to the assessment test in the study area.

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Table 3: Mean Leaflets Width of *Moringa oleifera* (LAM) Assessed at Different Dates in Sudan Ecology Zone of Nigeria

Treatment	Mean Leaflets Width of Seedlings by Date of Assessment		
	Day10th	Day 20th	Day 30th
A	1.33 ±0.12 a	1.43 ±0.11 a	1.64 ±0.13 a
B	1.25 ±0.16 a	1.60 ±0.12 a	1.78 ±0.12 a
C	1.47 ±0.17 a	1.64 ±0.15 a	2.17 ±0.09 b

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

The result on table 4 shows the mean leaflets number of *Moringa oleifera (Lam)* treatments at 3 different dates. Analysis of Variance test of the leaflets number showed no significant difference in the leaflets number with all treatments (F=0.27, P=0.76 P>0.05) on the 10th day and 20th day (F=0.75, P=0.48 P>0.05). The results on the 30th day showed significant variations (F=2.59, P=0.01 P>0.05) with treatment C thrived better than treatments A and B.

Table 4: Mean Leaflets Number of *Moringa oleifera* (LAM) Seedlings Assessed at three Different Dates in Sudan Ecology Zone of Nigeria

Treatment	Mean Leaflet number by Date of Assessment		
	Day 10th	Day 20th	Day 30th
A	3.37 ±0.11 a	5.85 ±0.13 a	7.15 ±0.27 a
B	3.18 ±0.23 a	5.65 ±0.24 a	6.95 ±0.35 a b
C	3.28 ±0.18 a	6.00 ±0.21 a	7.81 ±0.23 b

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

CONCLUSION AND RECOMMENDATION

Germination and early growth rate of *Moringa oleifera* seeds in treatment C (topsoil & river sand) has demonstrated better growth potential on the average, than seeds planted in treatments A and B, respectively. Based on the results obtained, it is evident that *Moringa oleifera* (Lam) thrives well when raised in treatment C, which is a mixture of topsoil and river sand in ratio 2:1.

M. oleifera (LAM) is highly economic, that deserves cultivation for its various uses. In view of this, it is therefore, recommend that:

1. For nursery establishment, *Moringa oleifera* seeds should be planted using treatment C (topsoil and river sand) which is the best medium for germination and early growth rate.
2. The topsoil and river sand (treatment C) was the best medium for raising Moringa seedlings plant at nursery stage in this ecology zone of Nigeria.
3. Other treatments possibly attracted Insects and Pests in the process of decomposition or as the manure decayed further and are detrimental as they affect the seedlings vigor. Further research on pests and insects of *Moringa oleifera* seedlings should be conducted as Insect and Pest attack/ problems were encountered during this research work at the nursery stage.

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