

MEDIA EFFECTS ON EMERGENCE AND GROWTH OF MORINGA (MORINGA OLEIFERA LAM) SEEDLINGS GROWN IN THE NURSERY

ABSTRACT

The study was carried out where? to determine the effects of different sowing media on emergence and growth of moringa (*Moringaoleifera*Lam) seedlings grown in the nursery. The moringa seeds used for the study were collected from different parts of Nigeria; Nsukka (Eastern Nigeria), Ibadan (Western Nigeria) and Jos (Northern Nigeria). The sowing media were sawdust (100%), top soil (100%), sawdust + poultry manure in the ratio of 2:1(volume by volume; v/v), and top soil + poultry manure + river sand in the ratio of 3:2:1(v/v/v). Perforated black polythene bags were used foras potting the media. Physical and chemical properties of the sowing media were determined through laboratory analyses before sowing the seeds. The experiment was a 3 x 4 factorial trial in completely randomized design with three replications. The seeds sown in the 100% topsoil took average of 8.22 and 9.00 days to have first and 50% seedling emergence while the seedlings in the topsoil + poultry manure + river sand used the least mean number of days (5.11) to emerge. Sawdust medium gave the highest mean percentage seedling emergence (84.4%) followed by sawdust + poultry manure (82.2%). The sawdust + poultry manure had the highest coefficient velocity of seedling emergence (11.44%) followed by the 100% sawdust (11.36%). The topsoil + poultry manure + river sand gave the least values of both total percentage (16.22%) and coefficient velocity of seedling emergence (2.92%) respectively. The three accessions had no significant differences ($p > 0.05$) in their morphological growth traits measured at two and four weeks after planting.

Key words: Moringa, morphological growth, seedling emergence, sowing media

INTRODUCTION

Moringa farms are easily established either by cuttings or seeds. Seeds are either sown directly in the field at the onset of the rainy season or planted in the nursery. Nursery operations involve raising seedlings in different media. Nursery potting media influence quality of seedlings produced thereof (Sakin et al., 2005; Agbo and Omaliko, 2006). The quality of seedlings obtained from a nursery influences re-establishment in the field and the eventual productivity of the

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plants. The traditional nursery potting medium in Nigeria is topsoil dug up from farmland and amended with poultry manure. Digging up agricultural soils will not only render the land unproductive for cropping, but will also make the land prone to erosion and other forms of degradation (Baiyeri, 2003). The quality of seedlings obtained is influenced by the composition of media used (Cortiet al., 1998; Wilson et al., 2001; Sahinet al., 2005). Ekwu and Mbah (2001) reported on the relative importance of soiless media for growing potted ornamental plants in Nigeria. Baiyeri (2005) evaluated three soiless media for weaning banana plantlets. The study showed that most of the genotypes evaluated grew into high quality seedlings when grown in rice hull (RH) composted with poultry manure (PM). Percentage germination and seedling emergence in different sowing media are determined by the composition of the media and the particle sizes of the different components of the media. Use of coarse materials as parts of the sowing medium will ensure greater aeration and drainage of the medium which will enhance germination and seedling emergence (Ndubuaku and Oyekanmi, 2000).

Moringa is a fast-growing plant. The seeds germinate within five to ten days of planting. It has a short nursery span (four to eight weeks) because of the fast growing and deep-penetrating tuberous tap root which usually grows beyond the depth of the sowing medium within a few weeks of planting (Fuglie, 1999). Some of the soiless materials used as sowing media, such as sawdust and rice husks, provide conducive environment for seed germination and seedling emergence as well as subsequent early seedling growth when mixed with manure (Wilson et al., 2001). High percentage seed loss has been observed in direct planting of moringa seeds as many of them are destroyed by termites and rodents in the field (Becker et al., 2001). There is, therefore, the need to establish moringa farms via nursery planting and subsequent transplanting to the field to reduce seed and seedling losses and ensure that healthy and vigorous seedlings are planted in the field. The objective of the study was to determine the effects of different sowing media on emergence and early growth of moringa seedlings in the nursery.

MATERIALS AND METHODS

The experiment was carried out

The moringa seeds used for the study were collected from different parts of Nigeria; Nsukka (Eastern Nigeria), Ibadan (Western Nigeria) and Jos (Northern Nigeria). The sowing media used were sawdust (100%), top soil (100%), sawdust + poultry manure in the ratio of 2:1 (volume by volume; v/v), and top soil + poultry manure + river sand in the ratio of

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3:2:1(v/v/v). Perforated black polythene bags were used for potting the media. Physical and chemical properties of the sowing media were determined through laboratory analyses before sowing the seeds. Seeds were collected from dry pods of the different moringa accessions and sown in the media in an un-shaded nursery. The experiment was a 3 x 4 factorial trial in completely randomized design with three replications. Ten seeds were planted per polythene bag. Emergence was noted at the protrusion of the first foliage leaf above the surface of the sowing medium. Seedling emergence was counted on daily basis. Percentage seedling emergence was determined using the formula:

$$E\% = \frac{\text{Number of emerged seedlings}}{\text{total number of seeds planted}} \times \frac{100}{1}$$

Where %E = percentage seedling emergence

Coefficient velocity of seedling emergence (CVE) was calculated using KOTOSKI (1978) formula as follows:

$$CVE = \frac{1}{N_1T_1 + N_2T_2 + \dots N_xT_x} \times \frac{100}{1}$$

Where N = Number of seeds emerging within the consecutive intervals of time. T = time between the beginning and end of a particular interval of measurement.

Days to first and 50% seedling emergence were recorded as the number of days from date of sowing to first and 50% seedling appearance.

The morphological growth parameters measured were plant height (cm), stem girth (cm) and number of leaves. The plant height was measured from the root/shoot junction to the shoot tip using a meter rule. The stem girth was determined by multiplying the stem diameter by 22/7 (π).

$$\text{Stem Girth} = \text{Stem Diameter} \times 22/7 (\pi)$$

The number of the leaves was determined by counting. All the morphological parameters were measured biweekly for four weeks after planting.

Data analysis??

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Comment [H6]: How about crop protection? Any seed treatment?

Comment [H7]: What was the planting/sowing depth used? This is quite critical in this research as it affects the entire research

Comment [H8]: How was the experiment managed?

Comment [H9]: Data analysis must be stated. How was the data analysed?

RESULTS AND DISCUSSION

The sawdust + poultry manure (SD + PM) had the highest total porosity (70.84%) and the least bulk density (0.71 gm/cm³). The 100% topsoil (TS) had the highest bulk density (1.56 g/cm³) and least porosity (41.13%). The topsoil + poultry manure + river sand (TS + PM+ RS) had the highest water holding capacity (35.19%) and the 100% sawdust (SD) the least (28.33%). There were significant differences ($p < 0.05$) in the porosity of the different media (Table 1). The 100% sawdust and sawdust + poultry manure had the highest organic carbon and organic matter contents (20.15% for organic carbon and 34.74 for organic matter) each. The sawdust + poultry manure had the highest values of total nitrogen (1.12%), potassium (0.52%), phosphorus (0.21) and pH in water (7.2) while the 100% topsoil had the least values of all the chemical properties except the total nitrogen content. There were significant differences ($p < 0.05$) in the chemical contents of the sowing media except the pH (both in water and KCl) values as shown in Table 1.

The seeds sown in the 100% topsoil took average of 8.22 and 9.00 days to have first and 50% seedling emergence while the seedlings in the topsoil + poultry manure + river sand used the least mean number of days (5.11) to emerge. Sawdust medium gave the highest mean percentage seedling emergence (84.4%) followed by sawdust + poultry manure (82.2%). The sawdust + poultry manure had the highest coefficient velocity of seedling emergence (11.44%) followed by the 100% sawdust (11.36%). The topsoil + poultry manure + river sand gave the least values of both total percentage (16.22%) and coefficient velocity of seedling emergence (2.92%), respectively. There were significant differences ($p < 0.05$) in the total percentage and coefficient velocity of seedling emergence in the different media (Table 2). The seedlings of the moringa seeds collected from Nsukka (Nsukka accession) emerged most promptly with the least average number of days to first and 50% emergence (6.17 and 6.75 days respectively). Jos accession had the highest percentage and coefficient velocity of emergence followed by Nsukka and Ibadan accessions respectively. There were significant differences ($p < 0.05$) in the total percentage and coefficient velocity of seedling emergence among the different accessions (Table 3).

After four weeks of planting, the seedlings grown in 100% topsoil had the highest values of plant height and stem girth followed by those grown in 100% sawdust, sawdust + poultry manure and topsoil + poultry manure + river sand in that order (Figures 1 and 2). Sawdust + poultry manure gave the highest number of leaves in the seedlings while the mixture of topsoil +

127 poultry manure + river sand gave the least (Figure 3). There were no significant differences ($p >$
128 0.05) in the morphological traits of the seedlings in the different sowing media. There may be
129 significant observable differences as the nursery period progresses. However, moringa seedlings
130 are best transplanted to the field with the ball of earth (soil around the root system) between one
131 and two months of nursery life because of their long tuberous roots which fast penetrate the soil
132 through the base of the polythene bag. Otherwise, the seeds should be planted at stake (directly)
133 in the field as earlier suggested by Fuglie (1999). The Nsukka accession gave the highest plant
134 height values in the second and fourth week of planting while the Jos accession had the highest
135 stem girth values at both periods of growth. The Ibadan accession had the least values of all the
136 morphological growth traits at both periods. However, there were no significant differences ($p >$
137 0.05) in the growth traits of the seedlings of the three accessions all through the period of
138 observation (Table 4).

139 Lower bulk densities and higher porosity of the 100% sawdust and the sawdust + poultry
140 manure (soiless) media might have aided prompt emergence and higher coefficient velocity of
141 emergence of the seedlings grown in the media. Though the seedlings emerged most promptly in
142 the topsoil + poultry manure + river sand medium, there were least percentage emergence and
143 coefficient velocity of seedling emergence in the medium and this would have been the reason
144 for the poor morphological (vegetative) growth obtained in the medium. The seedlings had
145 relatively higher coefficient velocity of emergence (11.36% and 11.44%) and total percentage
146 emergence (84.4% and 82.2%) in the 100% sawdust and sawdust + poultry manure compared to
147 the other media. The two soiless media also compared favourably with the 100% topsoil medium
148 (control) in promoting early nursery growth of the seedlings as shown in Figures 1 – 3. All these
149 attributes qualify the sawdust and sawdust + poultry media as good growth media for crop
150 seedlings with short nursery lives. The sawdust and sawdust + poultry manure were rich in the
151 vital nutrient elements such as percentage carbon, organic matter, nitrogen, phosphorus and
152 potassium. For sustainable nursery growth, sawdust + poultry manure may be preferred. The use
153 of soiless media as nursery potting media will reduce digging of topsoil from agricultural lands
154 and consequent exposure of the lands to erosion and other forms of degradation as earlier pointed
155 out by Baiyeri (2003 and 2005). Ekwu and Mbah (2001) reported the relative importance of
156 soiless media for growing potted ornamental plants in Nigeria. In Nigeria, sawdust is regarded as
157 waste from carpenters' workshops and is often times burnt to reduce the bulk. Use of sawdust as

nursery potting medium is a score in organic agriculture as a means of converting organic waste to useful agricultural material. It also reduces air pollution caused by smoke and release of greenhouse gases which deplete the ozone layer and result to global warming.

The non-accessional differences obtained in the emergence and morphological growth of the seedlings suggest relative homogeneity in the genetic compositions of the planting materials (seeds) from different parts of the country irrespective of their phenotypic differences.

CONCLUSION

Sawdust and sawdust + poultry manure were found to ~~posses~~possess good physico-chemical properties that could promote emergence and morphological growth of the seedlings in the nursery and, therefore, could be used as good substitutes for topsoil in short duration nursery establishment of crops seedling like moringa.

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224 **Table 1: Physical and chemical properties of media used for raising *Moringaoleifera***
 225 **seedlings in the nursery**

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Potting media				
Properties	100% SD	2:1 SD+PM	100% (TS)	3:2:1 TS+PM+RS
Physical				
Total porosity (%)	69.81	70.84	41.13	47.17
Water holding capacity (%)	28.33	31.12	30.79	35.19
Bulk density (g/cm ³)	0.80	0.71	1.56	1.40
Chemical				
Organic carbon (%)	20.15	20.15	1.15	2.15
Organic matter (%)	34.74	34.74	1.98	3.71
Total nitrogen (%)	0.140	1.121	0.084	0.070
Potassium (%)	0.239	0.523	0.08	0.08
Phosphorus (%)	0.09	0.21	0.0029	0.0117
pH (H ₂ O)	6.7	7.2	6.2	6.8
pH (Kcl)	5.8	6.5	5.0	6.6

227 SD + PM = Sawdust + poultry manure, TS + PM + RS = Topsoil + poultry manure + River sand,
 228 TS = Topsoil

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230 **Table 2: Effects of media on the seedling emergence of the *Moringaoleiferaplant***

Media	DE ₁	DE ₅₀	PE(%)	CVE(%)
TS	8.22	9.00	73.3	11.09
SD	8.00	8.44	84.4	11.36
SD+PM	7.78	8.22	82.2	11.44
TS+RS+PM	5.11	5.11	8.9	4.16
LSD _(0.05)	ns	ns	16.22	2.92

231 DE₁ = Days to first seedling emergence, DE₅₀ = Days to 50% seedling emergence, PE = Percentage seedling
232 emergence, CVE = Coefficient velocity of emergence.
233 ns = Not significant, LSD_(0.05) = Least significant difference at 5% probability level
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236 **Table 3: Effects of accessions of *Moringaoleifera* on seedling emergence**

Accession	DE ₁	DE ₅₀	PE(%)	CVE(%)
Nsukka	6.17	6.75	68.3	9.95
Jos	7.92	8.17	70.0	10.29
Ibadan	7.75	8.17	48.3	8.30
LSD _(0.05)	ns	ns	14.04	2.53

237 DE₁ = Days to first seedling emergence, DE₅₀ = Days to 50% seedling emergence, PE = Percentage seedling
238 emergence, CVE = Coefficient velocity of emergence.
239 ns = Not significant, LSD_(0.05) = Least significance different at 5% probability level
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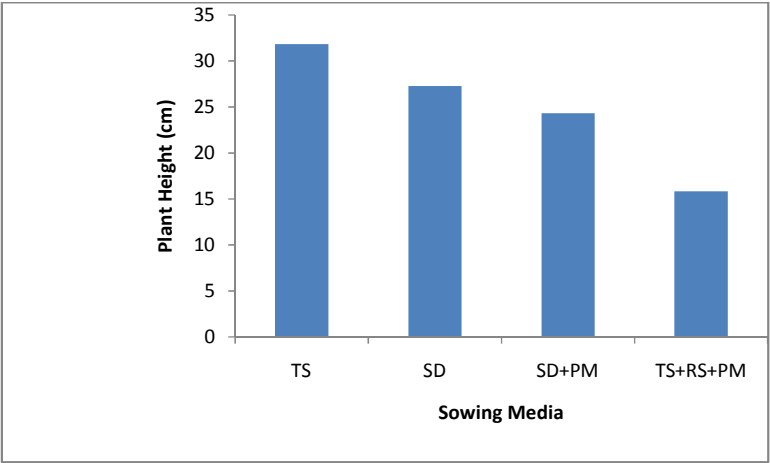
244 **Table 4: Effects of accessions on morphological growth traits of the *Moringaoleiferaplants***
245 **at two and four weeks after planting at where?**

2 WAP			4 WAP			
Accession	PHT(cm)	SG(cm)	NL	PHT(cm)	SG(cm)	NL
Nsukka	6.89	0.61	3.67	13.4	0.93	6.33
Jos	6.29	0.62	3.67	12.3	0.97	6.42
Ibadan	5.01	0.51	2.50	8.2	0.67	5.33
LSD _(0.05)	ns	ns	ns	ns	ns	ns

246 PHT = Plant height, SG = Stem girth, NL = Number of leaves, LSD_(0.05) = Least significant difference at 5% probability
247 level, ns = not significant
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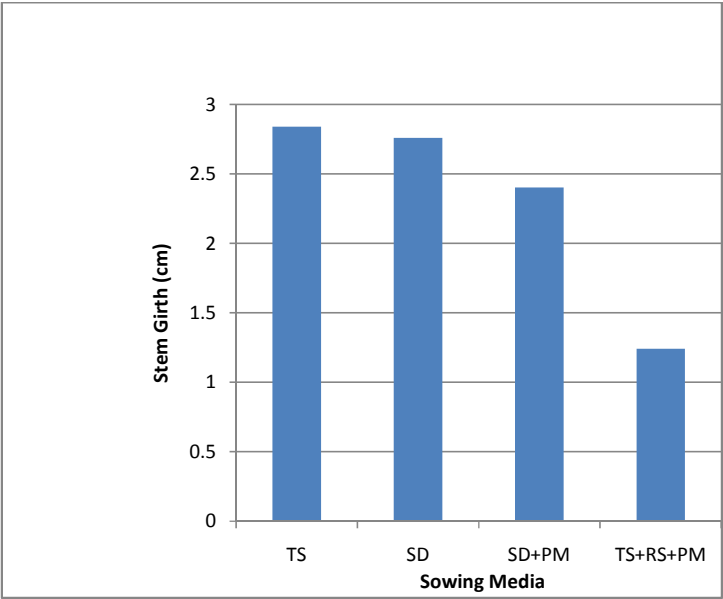
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Fig 1: Effect of different sowing media on plant height (cm) of *Moringaoleifera* in the nursery at four weeks after planting (WAP)

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260 Fig 2: Effect of different sowing media on stem girth (cm) of *Moringaoleifer*plants in the
261 nursery at four weeks after planting (WAP)

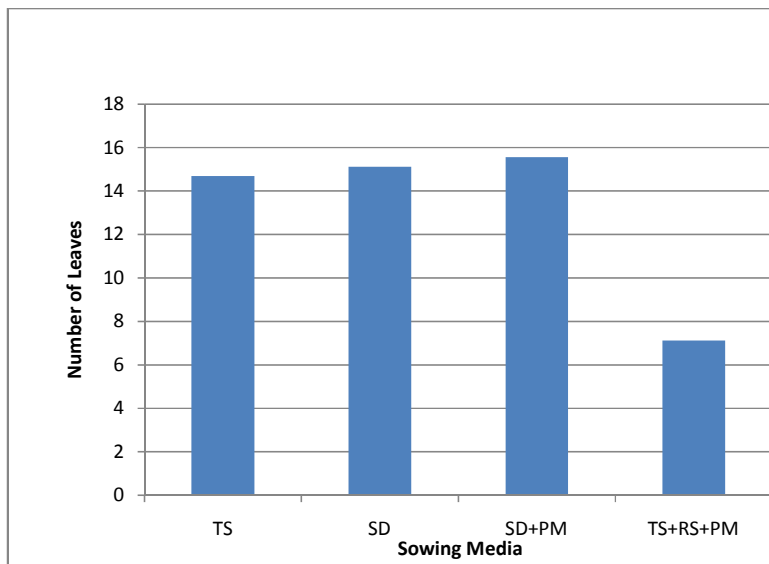


Fig 3: Effect of different sowing media on number of leaves of *Moringaoleifer*aplants in the nursery at four weeks after planting (WAP)