

EFFECTS OF ORGANIC GROWING MEDIA ON EARLY EMERGENCE AND SEEDLING GROWTH OF MORINGA (*Moringa oleifera* L.) IN DADIN KOWA, GOMBE STATE, NIGERIA

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ABSTRACT

This study was conducted with the aim of determining the effects of organic growing media on early emergence and seedling growth of moringa (moringa oleifera l.) in dadin kowa, Gombe State. The experiment was conducted at the Research and training Farm of the Federal College of Horticulture Dadin-kowa during the 2019 rainy season. The treatments were T1= top soil + cowdung, T2= topsoil+ horse dropping, T3 =Poultry litter, and T4= topsoil only which serves as a control. The design adapted during the experiment was Complete Randomized Design (CRD) replicated three times. Data obtained were subjected to Analysis of variance (ANOVA) and the mean were separated using Least Significant difference (LSD) at 5% level of probability. The result revealed that T2 (Topsoil + Horse dropping) gave the highest plant height, number of leaves, number of branches and collar stem girth in 2, 3 and 4 weeks after planting. Hence, it can be suggested for adoption to farmers and nursery owners. Therefore, it concluded that application of organic manure especially horse dropping will enhance germination and early seedlings growth of moringa in the study area. It is also recommended that horse dropping and cow dung in combination to topsoil should be used as potting mixture at the ratio 2:1 for effective germination and early growth of moringa oleifera by researchers, nursery owners and farmers.

Keywords: Moringa, Organic growing media, Emergence, Seedling growth.

1 INTRODUCTION

Moringa (*Moringa oleifera*) widely known as moringa, is a tropical crop and the most cultivated species of the family moringaceae which consist of thirteen (13) species [1]. The species include *Moringa oleifera* Lam, *M. arborea* Verdc, *M. borziana* Mattei, *M. concanensis* Nimmo, *M. drouhardii* Jum, etc. *Moringa oleifera* is the most widely cultivated because of its high nutritional, medicinal, agricultural, domestic and environmental purposes. Moringa plants 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 nurseries. Nursery operations involve raising seedlings in different media. Nursery potting media influence quality of seedlings produced thereof [2, 3] which subsequently influences their establishment and productivity in the field [4]. The traditional nursery potting medium in Nigeria is topsoil dug from farmland and amended with poultry manure. Digging agricultural soils not only renders the land unproductive for cropping, but also makes it prone to erosion and other forms of degradation [5]. Moringa is a fast-growing, deep-rooted dicotyledonous plant with tuberous taproot system. It is drought-tolerant and can thrive well in poor soils with little or no fertilization. *Moringa oleifera* plants can be irrigated during the dry season but should not be water-logged to avoid root rot. The trees can grow up to a height of 15 m. The leaves are tri-pinnate, usually 25-60 cm long. The plants flower about three times a year and produce average of 17 tonnes of seeds/ha/annum in Nigeria [6]. The flowers are pollinated by bees. The seeds have very short dormancy period and can germinate promptly immediately after harvest. The seeds germinate within five to ten days of planting and the seedlings

have short nursery life span (four to eight weeks) because of the fast growing nature of the plants [7]. The seeds lose their viability within one year of storage. Moringa can also be propagated using mature stem cuttings. The cuttings produce roots within two weeks of planting without any rooting hormone. The leaves are good sources of protein, minerals, vitamins, beta-carotene, amino acids and various phenolic compounds [8]. It is environmentally - friendly because of its ability to absorb a lot of the atmospheric carbon dioxide for its all-year-round leaf production (evergreen plant). It is a native of India but widely grown in parts of Afghanistan, Israel, Iran, Nepal, Bangladesh, China, Taiwan, Sri Lanka, Malaysia, Philippines, Thailand, Vietnam, Indonesia and Papua New Guinea [9]. Significant performance test was obtained as a primary coagulant (press cake) to clarify the waters of African rivers in the dry season [10]. Germination and seedling growth of moringa depends on environmental and genetic factors. Moringa seeds have no dormancy period, so they can be planted as soon as they are matured and will retain the ability to germinate for the period of one year.

2 MATERIALS AND METHODS

2.1 Experimental Site

The research was conducted at the Research and Training Farm of the Federal College of Horticulture Dadin-kowa, Yamaltu Deba Local Government Area of Gombe State, Nigeria, which is located on latitude 11° 30'N, and longitude of 10° 20'E with an altitude of 240m above sea level. The study area receives an annual rainfall of 760-1100mm, its optimum temperature ranges between 24-34°C and the soil type of the area is predominantly loamy.

2.2 Experimental Materials

The experimental materials used include the followings:

i) Polythene pots, Topsoil, ii) Cowdung, iii) Horse dropping, iv) Poultry litter, v) Wheel barrow, vi) Watering can, vii) Moringa seeds, viii) Water, ix) Scale rule

2.3 Treatment and Experimental Design

2.3.1 Treatments:

The experiment consisted of three (3) treatments which were prepared by mixing topsoil with cured organic source from (Cowdung, poultry litter and horse dung) at ratio 2:1 in polythene pots and top soil only as control as stated below:

- T1 = Topsoil + cowdung (2:1).
- T2 = Topsoil + horse droppings (2:1).
- T3 = Topsoil + poultry litter (2:1).
- T4 = Topsoil (control).

2.3.2 Experimental design

The design of the experiment was laid in Complete Randomized Design (RBD) with four replications.

2.3.3 Data Collection

Days to Emergence

The number of days for the seeds to emerge was counted and mean recorded.

Percentage of Emergence

The percentage of emergence was calculated using the following formula:

$$\% \text{ emergence} = \frac{\text{Number of plant emerged}}{\text{Number of seeds sown}} \times 100 \quad (1)$$

Plant Height

The height of the seedlings was taken from four (4) randomly selected plants using a calibrated meter rule (m) at 2, 4, 6 and 8 weeks after sowing.

Number of Leaves per Plant

The number of leaves per seedling was obtained from four (4) randomly sampled plants by physical count and recorded at 2, 4, 6 and 8 weeks' interval.

Stem Girth

Stem girth was measured from four (4) randomly sampled plants using vernier caliper at 2, 4, 6, and 8 weeks after sowing and the average was taken and recorded.

Number of Branches

The number of branches was counted physically at 2, 4, 6, and 8 weeks after sowing, the average was taken and recorded.

Data Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) using Genstat 3 discovery edition. The means were separated using the Least Significant Difference (LSD) at 5% level of probability.

3 RESULT AND DISCUSSION**3.1 Effect of Organic Growing Median of Moringa oleifera on Plant Height**

Table 1 shows the result of plant height. From the mean Plant height measurement of the four treatments at 2, 3 and 4 weeks after planting, it was observed that T2 (Topsoil + horse droppings) has the highest mean at 2, 3 and 4 weeks after planting, followed by T1 which is Topsoil + cowdung at 2, 3 and 4 weeks after planting, while T3 (Topsoil + Poultry litter) was observed the least with 20.3, 22.7 and 24.3 at 2, 3, and 4 WAP respectively. However, significant differences were observed from both the treatments at 5% level of probability. This can be supported by findings of [11] who reported that high nitrogen content in organic manure from cattle and horse dropping gave the best result.

Table 1. Effect of Organic Growing Media on Plant Height (cm) of Moringa

Treatment	Number of weeks		
	2 WAP	3 WAP	4 WAP
T1	25.7	27.9	29.6
T2	27.5	29.7	32.6
T3	20.3	22.7	24.3
T4	23.5	25.1	27.4
LSD _{0.05}	ns	1.87	2.02

LSD-Least Significant Difference, WAP-Weeks after Planting, ns-Non significant

3.2 Effect of Organic Growing Median of Moringa oleifera on Number of Leaves

Based on the analysis of the four treatments at 2, 3 and 4 weeks after planting, T2 (Topsoil + horse droppings) has the highest number of leaves at 2, 3 and 4 weeks after planting, followed by T1 which is Topsoil + cowdung at 2, 3 and 4 weeks after planting, while T3 (Topsoil + Poultry litter) was observed the lowest number of leaves at 2, 3, and 4 WAP respectively (Table 2). However, significant differences were observed from both the treatments at 5% level of probability. This is in agreement with observations by [12] that the excess of humidity on the treatments with manure may provoke germination losses and diminishing of the root growth and the aerial part of some tree species like Moringa. The slightly lower germination of treatments with high poultry manure levels could also be associated with illuviation of manure into the subsurface resulting in compression of the treatment layer and crust formation, and reduced aeration resulting in root asphyxiation [13] leading to a reduction of the germination and emergence process.

Table 2. Effect of Organic Growing Media on Number of Leaves of Moringa

Treatment	Number of weeks		
	2 WAP	3 WAP	4 WAP
T1	40.8	58.5	74.9
T2	50.8	70.4	78.0
T3	22.9	27.5	64.5
T4	36.8	47.2	69.5
LSD _{0.05}	4.64	9.50	ns

LSD-Least Significant Difference, WAP-Weeks after Planting, ns-Non significant

3.3 Effect of Organic Growing Median of Moringa oleifera on Number of Branches

Table 3 shows the result of number of branches. Moringa is adapted to a wide range of soil types but grows best in well drained loam to clay loam, neutral to slightly acidic soils, but cannot withstand prolonged water logging [1, 12]. Its introduction as a field crop has required propagation through seeds which are usually planted in the nursery using a light media of 3/1 proportion mixture of soil and sand, respectively [14]. Based on the analysis of the four treatments at 2, 3 and 4 weeks after planting, T2 (Topsoil + horse droppings) has the highest number of branches at 2, 3 and 4 weeks after planting, followed by T1 which is Topsoil + cowdung at 2 and 3 weeks after planting, while T3 (Topsoil + Poultry litter) was also observed the lowest number of branches at 2, 3, and 4 WAP respectively. However, significant differences were also observed from both the treatments at 5% level of probability. [15] suggested that the use of garden/topsoil leads to a germination percentage above 70% after three weeks.

Table 3. Effect of Organic Growing Media on Number of Branches of Moringa

Treatment	Number of weeks		
	2 WAP	3 WAP	4 WAP
T1	4.4	5.2	6.1
T2	5.5	7.2	8.3
T3	2.2	3.1	4.9
T4	3.9	5.1	6.6
LSD	0.21	0.34	0.95

LSD-Least Significant Difference, WAP-Weeks after Planting.

3.4 Effect of Organic Growing Median of Moringa oleifera on Stem Collar Girth

Based on the analysis of the four treatments at 2, 3 and 4 weeks after planting, T2 (Topsoil + horse droppings) was observed the highest mean of stem collar girth at 2, 3 and 4 weeks after planting, followed by T1 which is Topsoil + cowdung at 2, 3 and 4 weeks after planting, while T3 (Topsoil + Poultry litter) has the least mean of stem collar girth at 2, 3, and 4 WAP respectively (Table 4). However, significant differences were also observed from both the treatments at 5% level of probability. The application of manure increased plant height, number of leaves and stem girth of the plants. This observation agrees with earlier reports of [16, 17, 18] that animal manure is a valuable source of crop nutrients and organic matter, which can improve the soil biophysical conditions making the soil more productive and sustainable for plant growth. [19] specifically noted that application of organic fertilizers significantly improves the soil chemical properties and nutrient uptake in plants, thereby enhancing plant growth.

Table 4. Effect of Organic Growing Media on Stem Collar Girth of Moringa

Treatment	Number of weeks		
	2 WAP	3 WAP	4 WAP
T1	1.1	1.4	1.7
T2	1.6	1.9	2.3
T3	0.3	0.6	1.1
T4	0.5	1.1	1.4
LSD	0.11	0.10	0.14

LSD-Least Significant Difference, WAP-Weeks after Planting.

4 CONCLUSION

The result revealed that T2 (Topsoil + Horse dropping) gave the highest plant height, number of leaves, number of branches and collar stem girth in 2, 3 and 4 weeks after planting. Base on the result of this experiment, it can be concluded that application of organic manure will enhance germination and early seedlings growth of moringa in the study area. Hence, it can be suggested that horse dropping and cowdung in combination to topsoil should be used as potting mixture at the ratio 2:1 for effective germination and early growth of *moringa oleifera* by researchers, nursery owners and farmers.

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