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Effect of germination and seedling vigour for the most ideal soil media of different varieties of drumstick (*Moringa oleifera*. L) under net house condition

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Abstract

The investigation was carried out in *kharif* season 2017-18 conducted at the College nursery, Department of Horticulture, College of Agriculture, Indore (M.P.) to study the germination and emergence parameters, seedling vigour, as influenced by different varieties and media's. The experimental materials for the present investigation were practiced with factorial experiment in completely randomized design replicated thrice with different combinations of variety and media. The experiment was comprised of two varieties i.e. Bhagyalaxmi and local in combination with six different potting media's viz. V1T1 (Bhagyalaxmi with only soil 100 percent), V2T2 (Bhagyalaxmi with only sand 100 percent), V1T3 (Bhagyalaxmi with soil+ cocopeat 3:1), V1T4 (Bhagyalaxmi with soil+ FYM 3:1), V1T5 (Bhagyalaxmi with soil+ Poultry manure 3:1), V1T6 (Bhagyalaxmi with soil+ vermicompost 3:1), V2T1 (Local with only soil 100 percent), V2T2 (Local with only sand 100 percent), V2T3 (Local+ soil+ cocopeat 3:1), V2T4 (Local+ soil+ FYM 3:1), V2T5 (Local+ soil+ poultry manure 3:1), V2T6 (Local+ soil+ vermicompost 3:1). The treatment V2T2 (Local+ only sand) was found to be significantly superior in days taken to emergence in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) whereas treatment V1T6 (Bhagyalaxmi + soil + vermicompost 3:1) shows lowest in days taken to emergence. However, in germination percentage treatment V1T6 (Bhagyalaxmi + soil + vermicompost 3:1) was found to be significantly surpassing in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) and minimum was observed in V2T2 (Local+ only sand). The treatment V1T6 (Bhagyalaxmi + soil + vermicompost 3:1) shows superiority in terms of seedling Vigour parameters as compared to rest of the treatments in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) viz., Vigour index-1, Vigour index -2, root length, root fresh weight, root dry weight, shoot fresh weight, shoot dry weight, total fresh weight, total dry weight, and leaf area. Whereas, treatment V2T2 (Local+ only sand) was found to be lowest in contrary to with other treatments in seedling Vigour parameters.

Keywords: drumstick; vermicompost, FYM, cocopeat, poultry manure; sand; soil; seedlings; germination; seedling vigour

Introduction

Drumstick (*Moringa oleifera*. Lam) is an important vegetable crop belonging to the family Moringaceae having chromosome no. $2n = 28$. It has tremendous economic and dietic importance. It is fast growing, drought -resistant tree, native to North-western India, and widely cultivated in tropical and subtropical areas where its young seed pods and leaves are used as vegetables. It has many medicinal values. Leaves, flowers and unripe fruits are used as vegetables, and roots and barks are used for medicinal purpose (Anwar *et al.* 2007) [4]. The flowers, leaves and roots are used for the treatment of ascites, rheumatism and venomous bites and as a cardiac and circulatory stimulant in some folk cures. The root bark and the roots of young tree are rubefacient and vesicant. More than three hundred diseases including cancer, diabetes and high blood pressure can be controlled or cured by *M. oleifera* (Anon. 2009) [5]. Its seeds are used for purifying water in some African countries (Suarez *et al.* 2003) [12]. All kinds of nutrient and amino acids needed for human body are available in this plant, so this tree is also called "*Miracle tree*". It contains protein, fiber, calcium, phosphorus, potassium, sulphur, iron, ascorbic acid, carotene, choline, thiamine, riboflavin, nicotinic acid, and a complete amino acid profile in a sufficient amount (Bau *et al.* 1994) [6].

The production of moringa is basically accelerated in the southern region of India and not familiar in the central zone. Being rich in carbohydrate, protein, potassium, iron, it can effectively combat with malnutrition in children. However, Madhya Pradesh has earned the dubious distinction of recording highest infant mortality rate (54 per 1000 birth) in the country (Shrikanth *et al.* 2014) [11]. Ede *et al.* (2015) has shown that some of the soilless 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. (Stoffella *et al.* 1997) [13] has shown that compost and other organic manures can serve as soil amendments to improve soil nutrient status. They provide a ready source of carbon and nitrogen for microorganisms in the soil, improve its structure, reduce erosion and lower the temperature at the soil surface and also aid in seed germination and increase its water holding capacity. Mature compost provides a stabilized form of organic matter and has the potential to enhance nutrient release in the soil (Adediran *et al.*, 2003) [3]. Such studies will ensure high establish rates of the seed sown out as the seed has also proven to be very difficult to acquire. High initial seedling establishment results in increased production levels via different soil potting media's and its importance for building up the potentiality of moringa's production. In direct sowing of moringa seeds in the field having high seed loss percentage due to the destruction by termites and rodents. Very limited research work done on soil media response in drumstick. Although, it is very advantageous for the production of vigorous and healthy seedlings. Therefore, keeping these points in view, the investigation was carried to enlighten the effect of germination and seedling vigour for the most ideal soil media of different varieties of drumstick (*Moringa oleifera*. L) under net house condition.

Material and Methods

The experiment was conducted at Nursery area, Department of Horticulture, College of Agriculture, Indore, and (M.P.) Freshly harvested drumsticks seeds Bhagalaxmi were obtained from University of Horticulture Sciences, Bagalkot, Karnataka and local seed had been sourced from Bhorkheda Bhalla district Ujjain, M.P from a progressive farmer for study. The experimental material for this study comprised of twelve treatments in combinations with different soil media's under Net house condition. The treatments and doses are presented below V1T1 = Bhagalaxmi with Only Soil 100% V1T2 = Bhagalaxmi with Only Sand 100% V1T3 = Bhagalaxmi with Soil + Cocopeat (3:1) V1T4 = Bhagalaxmi with Soil + FYM (3:1) V1T5 = Bhagalaxmi with Soil + Poultry manure (3:1) V1T6 = Bhagalaxmi with Soil + Vermicompost (3:1) V2T1 = Local with Only Soil 100% V2T2 = Local with Only Sand 100% V2T3 = Local with soil + Cocopeat (3:1) V2T4 = Local with Soil + FYM (3:1) V2T5 = Local with Soil + Poultry manure (3:1) V2T6 = Local with Soil + Vermicompost (3:1). Polybags with dimensions of about 18 cm in height and 12 cm in diameter were used. Bags were filled with different soil media's having soil, sand, FYM, Poultry manure, Cocopeat, Vermicompost in different compositions with NPK @ 10: 20: 05 g / polythene bags. To facilitate germination, the seeds were uniformly treated by soaking them in cold water for twenty four hours before sowing them directly into the poly bags. Two seeds per polythene bags were sown at two to three centimeter deep. Light irrigation was given after sowing. The media's used in the poly bags were sterilized with thermal @2g /m 2

respectively. Days to first and fifty percent seedling emergence were recorded as the number of days from date of sowing to first and fifty percent seedling emergence. It was recorded daily when the first foliage leaf appeared. The data were recorded as per standard procedure and analysed statistically as per design. Germination was visually monitored through the counting of germinated seedlings after every seven days and finalized at fifteen days. A moringa seed is considered germinated when the stalk appears above the ground. The seedling Vigour index was computed by adopting the following formula as suggested by Abdul-Baki and Anderson (1973) [1] was expressed in number

$$\text{Germination Percentage} = \frac{\text{No. of germinated seeds}}{\text{Total No. of seeds}} \times 100$$

$$\text{Vigour Index I} = \frac{\text{GP\%} \times \text{Seedling Length (cm)}}{100}$$

$$\text{Vigour index ii} = \text{seedling dry weight} \times \text{germination percent}$$

The data were subjected to analysis of variance (ANOVA).

Results and Discussion

Effect of varieties- Bhagalaxmi (V1) and Local (V2)

The varietal effect was found non – significant on days taken to emergence and germination percent was significantly influenced with varieties Data clearly indicated in the Table 1.1 magnitudinally more days taken to emergence was observed in variety V1 - Bhagalaxmi (7.80 days) as compared to variety V2- Local (7.60 days). Variety V1- Bhagalaxmi having higher germination percentage (81.70percent) and least was recorded in the variety V2 Local valued as (70.9 percent). Results are in the conformity with the results of Bhardwaj (2013) [7] who also observed that vermicompost along with the soil was found to be having least days of emergence and maximum germination percent in papaya. In contrast to these results observed highest germination percentage and seedling emergence in poultry manure in moringa. The various vegetative growth parameters like vigour index -1, vigour index-2., root length (cm), root fresh weight (g), root dry weight (g), shoot fresh weight (g), shoot dry weight (g), total fresh weight (g), total dry weight (g) and leaf area (cm²) observed at 30 DAS were found to be significant among the different treatments (Table 1) and maximum vigour index -1, vigour index-2, root length (cm), root fresh weight (g), root dry weight (g), shoot fresh weight (g), shoot dry weight (g), total fresh weight (g), total dry weight (g) and leaf area (cm²) was observed in variety V1 – Bhagalaxmi.

Effect of soil media

The observations examined in Table 1.2 on days taken to emergence, germination percentage, seed vigour index, root length (cm), root fresh weight (g), root dry weight (g), shoot fresh weight (g), shoot dry weight (g), total fresh weight (g), total dry weight (g) and leaf area (cm²) were significantly influenced by different potting media where as highest days taken to emergence (9.80) were seen in T₂ (Only Sand 100%) and germination percentage (94.32), seed vigour index-1-2150 and vigour index-2 (41.98), root length (4.41cm), root fresh weight (4.48g), root dry weight ((0.98g), shoot fresh weight (4.68g), shoot dry weight (2.40 g), total fresh weight (8.99g), total dry weight ((3.23g) and leaf area (3.68 cm²) were noted with significant result observed in T₆ (Soil + Vermicompost 3:1). The probable results are mainly due to the reason that vermicompost and soil simultaneously increases the water holding capacity and release available nutrients to the growing zone of the plants which increases the production of auxin, gibberellins, cytokinins and hence inoculated roots has larger proportion of younger roots and root elongation resulting in increased length and number of hairs. Hence, absorption of the nutrients from the soil will be increased and resulting higher root length, stem length, root and shoot fresh weight and dry weight of moringa plant. Similarly, vermicompost embedded with the soil

produce the positive impact on the growth of moringa plant. As vermicompost which is high in organic manure due to the presence of bioactive principles i.e. the abundance of earthworm population create the symbiotic association with the soil and plant rhizosphere zone that influence the rate of influx of nutrients from soil and create impact on root and shoot growth and development of the plant. These results are in the accordance with Abirami *et al.* (2010), Bhardwaj (2013) [7], Chiranjeevi *et al.* (2018) [8] and Zaller (2006) [14].

Effect of interaction (Variety and soil media)

Perusal of data in Table 2 reveals that the interaction of variety and media showed significant effect on the days taken to emergence parameter. Data clearly indicated that the treatment combination V2T2 (Local + only sand 100 percent) taken maximum days to emergence of sown drumstick seeds (10.70 days) where as

germination percent, Vigour Index -1. (2200), Vigour Index - 2. (46.19), root length (4.90 cm), shoot fresh weight (4.86 g), shoot dry weight (2.49 g), total fresh weight(9.29 g), total dry weight(3.39 g), leaf area (4.02cm²) were shown non-significant effect and root dry weight (1.05 g), root fresh weight (4.80 g) recorded with significant effect with in the treatment combination V1T6 (Bhagalaxmi + soil + vermicompost 3:1) followed by V1T5 (Bhagalaxmi + soil + poultry manure 3:1) it is probably due to vermicompost granules which may develop soil aggregates and will be able to improve permeability of airflow in the polybags and all these factors ultimately increase the seedling vigour of the plant (Bhardwaj 2013) [7]. The present results are in the accordance with the results of Bhardwaj (2013) [7] that vermicompost along with pond soil in nursery increases the seedling vigour and favourable for growth and development of papaya.

Table 1.1: Effect of variety and media on most ideal soil media of different varieties of drumstick (*Moringa oleifera*. L) under net house condition.

Treatments/ Varieties	Days taken to emergence	Germination percent	Vigour index -1	Vigour index - 2	Root length (cm)	Root fresh weight(g)	Root dry weight (g)	Shoot fresh weight (g)	Shoot dry weight (g)	Total fresh weight (g)	Total dry weight (g)	Leaf area (cm ²)
V1 Bhagalaxmi	7.80	81.70	1675	32.28	3.81	3.30	0.66	3.36	1.93	6.58	2.58	2.83
V2 Local	7.60	70.91	1483.33	26.91	3.24	2.68	0.47	3.18	1.63	5.82	2.05	2.44
SEm± (V)	0.18	0.74	40.58	0.79	0.14	0.06	0.01	0.10	0.08	0.11	0.09	0.08
CD at (5%) (V)	NS	2.14	118.22	2.29	0.42	0.19	0.04	NS	0.23	0.33	0.28	0.22

Table 1.2: Effect of ideal soil media on different varieties of drumstick (*Moringa oleifera*. L) under net house condition.

Treatments/ Soil Media	Days taken to emergence	Germination percent	Vigour index -1	Vigour index - 2	Root length (cm)	Root fresh weight (g)	Root dry weight (g)	Shoot fresh weight (g)	Shoot dry weight (g)	Total fresh weight (g)	Total dry weight (g)	Leaf area (cm ²)
T ₁ (Only Soil 100%)	8.80	65.52	1475.00	18.74	3.13	2.08	0.26	1.91	1.46	3.99	1.72	1.51
T ₂ (Only Sand 100%)	9.80	51.53	560.00	8.96	2.74	1.31	0.17	0.48	1.18	1.80	1.35	1.24
T ₃ (Soil + Cocopeat 3:1)	8.20	78.64	1725.00	35.24	3.75	3.01	0.56	3.97	1.74	6.98	2.44	3.18
T ₄ (Soil + FYM 3:1)	6.80	75.52	1676.67	35.42	2.97	3.08	0.45	3.96	1.93	7.04	2.38	2.67
T ₅ (Soil + Poultry Manure 3:1)	6.30	92.53	1888.33	34.22	4.14	4.00	0.97	4.63	1.98	8.40	2.80	3.53
T ₆ (Soil + Vermicompost 3:1)	6.20	94.32	2150.00	41.98	4.41	4.48	0.98	4.68	2.40	8.99	3.23	3.68
SEm± (M)	0.31	1.27	70.29	1.36	0.25	0.11	0.02	0.18	0.14	0.20	1.72	0.13
CD at (5%) (M)	0.90	3.71	204.76	3.96	0.73	0.32	0.07	0.52	0.40	0.57	1.35	0.38

Table 2: Interaction effect of variety and media on most ideal soil media of different varieties of drumstick (*Moringa oleifera*. L) under net house condition

Variety /Treatment	Germination percent		days to taken to emergence		Vigour index -1		Vigour index -2		Root length (cm)		Root fresh weight (g)		Root dry weight (g)		Shoot fresh weight (g)	
	V1	V2	V1	V2	V1	V2	V1	V2	V1	V2	V1	V2	V1	V2	V1	V2
T ₁ (Only Soil 100%)	69.61	61.43	9.70	8.00	3.09	3.16	2.19	1.96	0.32	0.19	1.88	1.94	1566.67	1383.33	21.80	15.68
T ₂ (Only Sand 100%)	54.33	48.73	9.00	10.70	2.87	2.37	1.35	1.27	0.21	0.12	0.57	0.40	780.00	340.00	10.46	7.45
T ₃ (Soil + Cocopeat 3:1)	87.53	69.63	7.30	9.00	3.96	3.54	3.76	2.26	0.80	0.32	4.04	3.89	1833.33	1616.67	38.51	31.97
T ₄ (Soil + FYM 3:1)	85.41	65.73	7.00	6.70	3.57	2.60	3.54	2.62	0.52	0.37	4.10	3.82	1703.33	1650.00	37.50	33.34
T ₅ (Soil + Poultry Manure 3:1)	95.91	89.23	6.01	6.30	4.44	3.84	4.17	3.83	1.02	0.92	4.69	4.56	1966.67	1810.00	39.21	29.23
T ₆ (Soil + Vermicompost 3:1)	97.52	91.03	5.70	6.70	4.90	3.92	4.80	4.16	1.05	0.90	4.86	4.49	2200.00	2100.00	46.19	37.77
SEm± (V X M)	1.80		0.44		0.44		1.92		0.35		0.16		0.03		0.50	
CD at (5%) (V X M)	NS		1.27		1.27		NS		NS		0.46		0.09		NS	

Variety /Treatment	Shoot dry weight (g)		Total fresh weight (g)		Total dry weight (g)		leaf area (cm ²)	
	V1	V2	V1	V2	V1	V2	V1	V2
T ₁ (Only Soil 100%)	1.64	1.28	4.07	3.90	1.96	1.48	1.60	1.41
T ₂ (Only Sand 100%)	1.30	1.05	1.92	1.67	1.52	1.17	1.32	1.15
T ₃ (Soil + Cocopeat 3:1)	2.03	1.45	7.80	6.16	3.11	1.77	3.37	2.99
T ₄ (Soil + FYM 3:1)	2.06	1.80	7.64	6.44	2.59	2.17	2.80	2.53
T ₅ (Soil + Poultry Manure 3:1)	2.07	1.90	8.74	8.07	2.92	2.67	3.84	3.21
T ₆ (Soil + Vermicompost 3:1)	2.49	2.31	9.29	8.69	3.39	3.07	4.02	3.33
SEm± (V X M)	0.20		0.28		0.23		0.19	
CD at (5%) (V X M)	NS		NS		NS		NS	

Conclusion

From the forgoing investigation, it can be concluded that among the two different varieties of Moringa variety V1- Bhagyalaxmi performed best when compared to variety V2 – Local. The variety V2 Local was poorest for all parameters except in days taken to emergence. In case of different soil media's T6 (soil + vermicompost 3:1) responded with superior results in various parameters. As far as the interaction effect is concerned between variety and media (VXM) the treatment combination VIT6 (Bhagyalaxmi+ soil+ vermicompost 3:1) showed with for most results.

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