Original Research Article

Effect of Seed Germination and Seedling Vigour in Different Soil Media for The Establishment of Annual Drumstick (*Moringa oleifera*) cv.PKM-1.

Effect of Seed Germination and Seedling Vigour in Different Soil Media for The Establishment

ABSTRACT

A field experiment on the "Effect of seed germination and seedling vigour in different soil media for the establishment of annual drumstick (*Moringa oleifera*) cv.PKM-1" was conducted during August to November 2021 in naturally ventilated polyhouse of Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). The experiment was conducted in Randomized Block Design consisting of 12 treatments and three replications. The experiment consisting of growing media fertilizers such as Soil, NPK, Perlite, Vermiculite, Biocompost, Bokashi and Coirpith in different combinations to evaluate the best media combination for the seed germination, seedling growth and establishment of annual drumstick. In this investigation the result reveal that the treatment T8 [Soil (50%) + Vermiculite (25%) + Perlite (25%)] was found bestin respect to the Germination parameters, Growth parameters and Physiological parameters like day to germination (7.0), germination percentage (87%), seed vigour index (3.03), plant height (140.03 cm), no. of leaves per plant (380.43), stem girth (2.05 cm), no. of nodes (34.17), length of inter node (20.15 cm), fresh weight of shoot (21.48 g), dry weight of shoot (10.50 g), fresh weight of root (8.54 g), dry weight of root (3.90g) and root : shoot ratio (0.40) of annual drumstick (*Moringa oleifera*) cv.PKM-1.

Keywords: Annual Drumstick, Soil, NPK, Perlite, Vermiculite, Biocompost, Bokashi and Coirpith

INTRODUCTION

The drumstick (*Moringa oleifera*) belongs to the family Moringaceae. It is a native of the Western Himalayas, It is an important perennial, multipurpose tree vegetable grown widely in India, Middle East and some other tropical countries. Popularly known as 'Ganigana. Mallakkai, Murrug, Sahjan and Marings. It is mainly grown for its green pods, an essential component of 'sambhar', a South Indian curry. Tender pods are sliced and used in culinary preparations and pickles. Flowers and tender leaves are eaten as potherb. Fried seeds taste like peanuts. Twigs and leaves provide valuable fodder for cattle. The wood is soft, white, spongy and perishable, used for making shuttles and picking-sticks for the textile industry. Wood pulp is also considered useful for newsprint. The white gum exuded by the tree turns red-brown on oxidation. It swells in water and produces a viscous solution, locally used in Calico printing. It's under leaves, flowers and immature or half mature pods are eaten. The seeds contain a colourless, oil known commercially as 'Ben off, used by watch-makers and much valued by perfume manufactures owing to its power of absorbing and retaining delicate scents. Oil is used locally for edible purposes, illumination and in cosmetics. Besides, it has a medicinal value also Leaves are rich in vitamins A and C hence is useful in scurvy

Consequent to the release of PKM-1 annual moringa, a bushy type amenable for seed propagation, the commercial cultivation has gained momentum in India. About 8.000 ha in Tamil Nadu, 6,000 ha in Andhra Pradesh and 2.000 ha in Maharashtra are under PKM-1 moringa. After first ratoon, the crop is removed and resown again for new crop. Among the limiting factors of productivity, the nutrients application and their response in the growth and development of moringa largely decide the productivity and is a vital factor in as much as the soil, crop response which is always dynamic and vary extremely. The bulk production of pods

(30 kg per tree) and leaves (100-120 kg per tree) depletes the soil nutrient status and an optimal replenishment strategy will help to maximize and maintain the productivity

Perlite's expanded nature makes it extremely porous, so it can absorb water, but it also improves drainage, so is ideal to mix into compost to ensure water drains freely. Perlite is particularly useful in plant propagation, including taking cuttings and sowing seeds. Vermiculite is a hydrous phyllosilicate mineral which undergoes significant expansion when heated. Exfoliation occurs when the mineral is heated sufficiently, and commercial furnaces can routinely produce this effect. Vermiculite forms by the weathering or hydrothermal alteration of biotite or phlogopite. Bokashi is a composting process that uses microorganisms known as 'Bokashi bran' to ferment organic food waste and create a super-fertile compost that will enrich your soil. The largest by products of coconut is coconut husk from which coir fibre is extracted. This extraction process generates a large quantity of dusty material called coir dust or coir pith. It improves the soil aggregation and water holding capacity (more than 5 times its dry weight) contributing towards increased soil moisture. There is improvement in cation exchange capacity of soils, where composted coir pith is applied. Coir pith compost application increased the soil native microflora because of addition of humic materials. Ammonification, nitrification and nitrogen fixation are increased due to improved microbiological activity.

Media influence quality of seedlings which subsequently influences their establishment and productivity in the field. A good growing medium provides sufficient anchorage or support. to the plant, serves as reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere outside the root substrate.

MATERIALS AND METHODS

The experiment was conducted in the Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (U.P) during 2021–2022. The experiment was laid out in randomized block design (R.B.D.) having 11+1 treatments with 3 replications of soil media tabulated in Table- 1. Annual drumstick cv.PKM-1 were potted in the polybags. Normal cultural practices and plant protection measures were followed during the cultivation process. Plants were selected at random from each plot of each Annual drumstick as representative sample for recording the data.

Table 1: List of Treatments Combination.

Sr. No	Treatments Combination
T0	Soil (75%) + NPK (25%)
T1	Soil (75%) + Perlite (25%)
T2	Soil (50%) + Vermiculite (50%)
T3	Soil (75%) + Biocompost (25%)
T4	Soil (50%) + Coirpith (50%)
T5	Bokashi (50%) + Vermiculite (50%)
T6	Bokashi (75%) + Soil (25%)

T7	Biocompost (75%) + Coirpith (25%)
T8	Soil (50%) + Vermiculite (25%) + Perlite (25%)
T9	Soil (50%) + Vermiculite (25%) + Coirpith (25%)
T10	Soil (50%) + Biocompost (25%) + Coirpith (25%)
T11	Soil (50%) + Bokashi (25%) + Coirpith (25%)

STATISTICAL ANALYSIS

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance **Fisher (1950).** The significance and non-significance of the treatment effect were judged with the help of 'f' value (variance ratio) was compared with the table value at 5% level of significance. If calculated value exceeded then the value, the effect of considered to be significant. The significant difference between the means was tested against the critical difference at 5% level of significance.

RESULTS AND DISCUSSION

A. Germination Parameters

Data pertaining to germination parameters which are Day to germination, Seed germination percentage (%), Seed vigour index and Survival percentage (%).

Days to germination

The Minimum number of days to germination (7.0 days) in the treatment T8 followed by the treatment T9 (7.7 days) and maximum number of days to germination was recorded in the treatment T0 (10.3 days).

Seed germination percentage (%)

The Maximum percentage of seed germination (87%) was record in the treatment T8 followed by T9 (86%) and minimum percentage of seed germination was recorded in the treatment T1 (78%).

Seed Vigour Index

The Maximum Seed Vigour Index (3.03) was record in the treatment T8 followed by T9 (2.93) and minimum Seed Vigour Index was recorded in the treatment T1 (1.93).

Table 2: Germination Parameters

Treatments	Days to germination	Seed germination %	Seed vigour index	Survival percentage
T0	10.3	79	2.03	66.67
T1	10.2	78	1.93	61.11
T2	9.5	81	2.33	72.22
T3	9.7	81	2.23	72.22
T4	9.9	80	2.13	66.67
T5	9.2	81	2.43	77.78
T6	8.9	83	2.53	77.67
T7	8.6	83	2.63	83.00
T8	7.0	87	3.03	94.33
T9	7.7	86	2.93	88.67

T10	8.3	84	2.73	83.00
T11	7.9	85	2.83	88.67
SEd (±)	**0.25**	**1.03**	**0.02**	**6.28**
CD (5%)	**0.52**	**2.14**	**0.44**	**13.02**
CV %	**3.42**	**1.53**	**9.39**	**9.9**

B. Growth parameters

Data pertaining to growth parameters which are Plant height, Stem girth (cm), Number leaves plant^{-1}, Number of nodes and Length of internode (cm).

Plant height (cm)

The maximum Plant Height at 30 days (43.50) was record in the treatment T8 followed by T9 (42.53) and minimum Plant Height at 30 days was recorded in the treatment T1 (36.13). The maximum Plant Height at 60 days (86.30) was record in the treatment T8 followed by T9 (85.87) and minimum Plant Height at 60 days was recorded in the treatment T1 (79.20). The maximum Plant Height at 90 days (140.03) was record in the treatment T8 followed by T9 (138.17) and minimum Plant Height at 90 days was recorded in the treatment T1 (101.33).

Stem girth (cm)

The maximum Stem Girth (cm) at 30 days (0.80) was record in the treatment T8 followed by T9 (0.77) and minimum Stem Girth (cm) at 30 days was recorded in the treatment T1 (0.64). The maximum Stem Girth (cm) at 60 days (1.26) was record in the treatment T8 followed by T9 (1.09) and minimum Stem Girth (cm) at 60 days was recorded in the treatment T1 (0.84). The maximum Stem Girth (cm) at 90 days (2.05) was record in the treatment T8 followed by T9 (1.76) and minimum Stem Girth (cm) at 90 days was recorded in the treatment T1 (1.45).

Number leaves plant^{-1}

The maximum number of leaves plant^{-1} at 30 days (74.83) was record in the treatment T8 followed by T9 (73.79) and minimum number of leaves plant^{-1} at 30 days was recorded in the treatment T1 (60.77). The maximum number of leaves plant^{-1} at 60 days (303.87) was record in the treatment T8 followed by T9 (286.10) and minimum number of leaves plant^{-1} at 60 days was recorded in the treatment T1 (248.20). The maximum number of leaves plant^{-1} at 90 days (380.43) was record in the treatment T8 followed by T9 (361.40) and minimum number of leaves plant^{-1} at 90 days was recorded in the treatment T1 (265.30).

Number of nodes

The maximum number of nodes at 30 days (12.58) was record in the treatment T8 followed by T9 (12.17) and minimum number of nodes at 30 days was recorded in the treatment T1 (10.08). The maximum number of nodes at 60 days (23.97) was record in the treatment T8 followed by T9 (22.21) and minimum number of nodes at 60 days was recorded in the treatment T1 (16.56). The maximum number of nodes at 90 days (34.17) was record in the treatment T8 followed by T9 (32.20) and minimum number of nodes at 90 days was recorded in the treatment T1 (21.56).

Length of internode (cm)

The maximum Length of Internode at 30 days (7.90) was record in the treatment T8 followed by T9 (7.70) and minimum Length of Internode at 30 days was recorded in the treatment T1 (5.28). The maximum Length of Internode at 60 days (14.92) was record in the treatment T8 followed by T9 (14.49) and minimum Length of Internode at 60 days was recorded in the treatment T1 (11.68). The maximum Length of Internode at 90 days (20.15) was record in the

treatment T8 followed by T9 (19.72) and minimum Length of Internode at 90 days was recorded in the treatment T1 (16.91).

Table 3: Growth parameters

Treatments	Plant height (cm)			Stem girth (cm)			No. Leaves plant^{-1}			Number of nodes plant^{-1}			Length of internode (cm)		
	30 days	60 days	90 days	30 days	60 days	90 days	30 days	60 days	90 days	30 days	60 days	90 days	30 days	60 days	90 days
T0	37.2	79.6	105.8	0.7	0.8	1.52	63.80	261.00	286.57	10.53	18.52	22.09	5.73	12.53	17.76
T1	36.1	79.2	101.3	0.6	0.8	1.45	60.77	248.20	265.30	10.08	16.56	21.56	5.28	11.68	16.91
T2	38.0	82.2	123.1	0.7	0.9	1.56	70.81	273.07	298.70	10.75	20.22	25.10	6.70	13.12	18.35
T3	37.2	81.0	120.3	0.7	0.8	1.54	68.80	268.07	297.40	10.75	19.95	23.57	6.37	12.79	18.03
T4	36.9	80.2	109.6	0.7	0.8	1.53	65.83	265.25	291.53	10.67	19.29	22.29	5.59	12.33	17.56
T5	38.6	82.5	125.8	0.7	0.9	1.57	71.28	275.10	307.27	11.08	20.82	26.35	6.77	13.15	18.39
T6	39.5	83.6	128.8	0.7	0.9	1.58	71.82	277.10	313.97	11.17	20.94	27.02	6.97	13.27	18.51
T7	40.6	84.1	131.0	0.7	0.9	1.58	72.57	278.17	322.27	11.50	21.29	28.15	7.17	13.56	18.79
T8	43.5	86.3	140.0	0.8	1.3	2.05	74.83	303.87	380.43	12.58	23.97	34.17	7.90	14.92	20.15
T9	42.5	85.9	138.2	0.8	1.1	1.76	73.79	286.10	361.40	12.17	22.21	32.20	7.70	14.49	19.72
T10	41.9	84.8	133.8	0.8	0.9	1.73	72.68	281.40	325.30	11.00	21.35	29.36	7.30	14.14	19.37
T11	42.2	85.1	135.6	0.8	0.10	1.70	73.30	284.20	351.63	11.75	21.97	30.07	7.50	14.21	19.44
SEd (±)	**0.52**	**0.39**	**0.48**	**0.01**	**0.01**	**0.01**	**0.31**	**0.41**	**0.81**	**0.53**	**0.48**	**0.47**	**0.38**	**0.35**	**0.35**
CD (5%)	**1.07**	**0.80**	**1.0**	**0.02**	**0.02**	**0.02**	**0.65**	**0.86**	**1.67**	**1.09**	**1.00**	**0.98**	**0.79**	**0.72**	**0.72**
CV %	**1.60**	**0.57**	**0.47**	**1.34**	**0.98**	**0.77**	**0.55**	**0.18**	**0.31**	**5.78**	**2.85**	**2.17**	**6.92**	**3.19**	**2.29**

C. Physiological parameters

Data pertaining to Physiological parameters which are Fresh weight of shoot (g), Fresh weight of root (g), Dry weight of shoot (g), Dry weight of root (g) and Root: shoot ratio.

Fresh weight of shoot (g)

The maximum fresh shoot weight (g) was (21.48) record in the treatment T8 followed by T9 (20.33) and minimum fresh shoot weight (g) was recorded in the treatment T1 (12.43).

Dry weight of shoot (g)

The maximum dry shoot weight (g) was (10.50) record in the treatment T8 followed by T9 (9.50) and minimum dry shoot weight (g) was recorded in the treatment T1 (5.46).

Fresh weight of root (g)

The maximum Fresh root weight (g) was (8.54) record in the treatment T8 followed by T9 (8.16) and minimum Fresh root weight (g) was recorded in the treatment T1 (6.09).

Dry weight of root (g)

The Maximum dry root weight (g) was (3.90) record in the treatment T8 followed by T9 (3.80) and minimum dry root weight (g) was recorded in the treatment T1 (2.37).

Root: shoot ratio.

The minimum root and shoot ratio was (0.40) record in the treatment T8 followed by T9 (0.40) and maximum root and shoot ratio was recorded in the treatment T1 (0.49).

Table 4: Physiological parameters

Treatments	Fresh weight of shoot (g)	Dry weight of shoot (g)	Fresh weight of root (g)	Dry weight of root (g)	Root and shoot ratio
T0	14.44	7.13	6.21	2.49	0.43
T1	12.43	5.46	6.09	2.37	0.49
T2	16.04	7.45	6.74	2.96	0.42
T3	15.44	7.31	6.60	2.83	0.43
T4	15.03	7.23	6.41	2.79	0.43
T5	16.32	7.51	6.82	2.96	0.42
T6	17.32	7.68	7.11	3.31	0.41
T7	18.09	8.12	7.13	3.33	0.39
T8	21.48	10.50	8.54	3.90	0.40
T9	20.33	9.50	8.16	3.80	0.40
T10	18.07	8.90	7.40	3.43	0.41
T11	20.14	9.25	7.61	3.53	0.38
SEd (±)	**0.43**	**0.58**	**0.71**	**0.45**	**0.01**
CD (5%)	**0.90**	**1.21**	**1.48**	**0.94**	**0.02**
CV %	**3.11**	**8.95**	**1.33**	**1.72**	**2**

CONCLUSION

It is concluded that the treatment T8 with Soil (50%) + Vermiculite (25%) + Perlite (25%) was recorded highest in terms of Germination parameters, Growth parameters and Physiological parameters like day to germination (7.0), germination percentage (87%), seed vigour index (3.03), plant height (140.03 cm), no. of leaves per plant (380.43), stem girth (2.05 cm), no. of nodes (34.17), length of inter node (20.15 cm), fresh weight of shoot (21.48 g), dry weight of shoot (10.50 g), fresh weight of root (8.54 g), dry weight of root (3.90g) and root : shoot ratio (0.40).

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