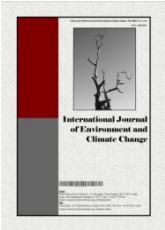

International Journal of Environment and Climate Change

12(11): 1401-1407, 2022; Article no.IJECC.90570
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

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

S. Sreehari [a*ω], Devi Singh [aω], C. John Wesley [aω] and Vijay Bahadur [aω]

[a] Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj - 211007, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i1131119

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/90570

Original Research Article

Received 02 June 2022
Accepted 08 August 2022
Published 11 August 2022

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, 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 consisted of using media and 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 reveald that the treatment T8 [Soil (50%) + Vermiculite (25%) + Perlite (25%)] was found best in respect to the germination parameters, growth parameters and physiological parameters like days to germination (7.0), germination percentage (87%), seed vigour index (3.03), plant height (140.03 cm), number of leaves per plant (380.43), stem girth (2.05 cm), number 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 L.*) cv.PKM-1.

[ω] M.Sc. Scholar;
**Corresponding author: E-mail: sreehari0477@gmail.com;*

Keywords: Annual drumstick; soil; NPK; perlite; vermiculite; biocompost; bokashi and coirpith.

1. INTRODUCTION

The drumstick (*Moringa oleifera* L.) belongs to the family Moringaceae. It is a native of the Western Himalayas, an important perennial, multipurpose tree vegetable cultivated in India, and widely distributed in Egypt, Phillipines, Sri Lanka, Thailand, Myanmar, Pakistan, Singapore, West Indies, Namibia, Cuba, Jamaica, Somalia, Nigeria etc 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 pot herb. Fried seeds gives taste like peanuts. Twigs and leaves provide valuable fodder for cattle. 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 Tender leaves, flowers and immature or half mature pods are eaten. The seeds contain a colourless, oil known commercially as 'Ben oil, 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. Every part of this plant is valuable for food and enriched with nutrients, minerals and vitamins. In addition to its edible and nutritional value, it has tremendous potential in medicinal and industrial features too [1-4].

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 nutrients and an optimal replenishment strategy will help to maximize and maintain the productivity [5-8].

In the Dravidian language, there are many local names for this tree but all are derived from the generic root "Morunga". In English it is commonly known as Horseradish tree, Drumstick tree, Never Die tree, West Indian Ben tree, and Radish tree [9].

Perlites is extremely porous because it is expanded from nature and it can absorb water and its also improve drainage which is ideal to mix into compost that help to ensure water drains freely. It is very usefull in plant propagation, including cuttings and sowings seed. 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 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 [10-15].

Moringa possess many valuable properties, which make it of great scientific interest. Few of them are high protein content in leaves, high protein and oil content in seeds, the large number of unique polypeptides in seeds that can bind many moieties, the presence of growth factor in the leaves etc. (Nikolavs Foidl et al., 2001).

2. 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 August 2021– November 2021. The experiment was laid out in randomized block design (R.B.D.) having 12 treatments with 3 replications of soil media tabulated in Table 1.

Annual drumstick cv.PKM-1 were sown in the polybags. Normal cultural practices and plant protection measures were followed during the cultivation process. Four Plants were selected at random from each treatment as representative sample for recording the data.

Seed germination percentage (%): Seedling emergence was recorded daily when the first foliage leaf appeared. Percentage seedling emergence was determined using the formula:

Germination % = (No. of seeds germinated / No. of seeds sown) x100

Seed Vigour Index: Seed vigour index is calculated by multiplying germination (%) and seedling length.

Fresh weight of shoot (g): The plants were carefully uprooted from the soil and were carefully washed to remove the soil adhering to the roots and shoots, the shoots were then separated from the roots. The weight was taken with the help of electronic balance and average value was computed.

Fresh weight of root (g): After carefully washing away the soil adhering to the roots and shoots, and separating the roots from the shoot, the fresh weight was recorded with the help of an electronic balance.

Dry weight of shoot (g): For dry weight plants were chopped and oven dried at 60°C for 3 hours. The weight was measured with the help of an electrical balance.

Dry weight of root (g): For dry weight plants, the plants were chopped and oven dried at 60°C for 3 hours. The weight was measured with the help of an electrical balance.

Root: Shoot ratio: The root: shoot ratio was calculated by dividing the weight of the root with that of the shoot.

2.1 Statistical Analysis

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance Fisher [16]. 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. The significant difference between the means was tested against the critical difference at 5% level of significance.

3. RESULTS

3.1 Germination Parameters

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

3.1.1 Days to germination

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

3.1.2 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%).

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%)

Table 2. Effect of different media on Days of germination, seed germination, seed vigour index, survival percentage of annual drumstick (*Moringa oleifera*) cv. PKM-1

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

Table 3. Effect of different media on plant height (cm), stem girth (cm), number of leaves, number of nodes, length of internodes(cm) of annual drumstick (*Moringa oleifera*) cv. PKM-1

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	90days	30 days	60 days	90 days	30 days	60 days	90 days
T0	37.2	79.6	105.8	0.7	1.52	2.53	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	1.45	2.44	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	1.56	2.55	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	1.54	2.54	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	1.53	2.53	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	1.57	2.57	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	1.58	2.58	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	1.58	2.58	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	2.05	4.05	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	1.76	3.77	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	1.73	3.37	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	1.70	3.09	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	0.05	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	0.10	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	0.77	2.12	0.55	0.18	0.31	5.78	2.85	2.17	6.92	3.19	2.29

3.1.3 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).

3.2 Growth Parameters

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

3.2.1 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 recorded 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).

3.2.2 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).

3.2.3 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).

3.2.4 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).

3.2.5 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).

3.3 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.

3.3.1 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).

3.3.2 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).

Table 4. Physiological parameters [90th day]

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

3.3.3 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).

3.3.4 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).

3.3.5 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).

4. CONCLUSION

It is concluded that the treatment T8 [Soil (50%) + Vermiculite (25%) + Perlite (25%)] was recorded highest in terms of germination parameters, growth parameters and Physiological parameters like, days to germination (7.0), germination percentage (87%), seed vigour index (3.03), plant height (140.03 cm), number of leaves per plant (380.43), stem girth (2.05 cm), number 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).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Asante WJ, Baatuuwie NB, Kwame OB. Initial response of *Moringa oleifera* seedlings to different soil amendments. Afr J Agric Res. 2012;7(45):6082-6.
2. MAA, LIO, SOO. Effect of goat dung and NPK fertilizer on soil and leaf nutrient content, growth and yield of pepper. Int J Soil Sci. 2007;2(2):142-7.
3. Bouyoucos GJ. The hydrometer as a new method for mechanical, analysis of soils. Soil Sci. 1952;23:343-54.
4. Bunty S, Abhilasha S. Mamta. Thakur, Anil, Handa. Int J Curr Microbiol Appl Sci ISSN: 2319-7706. 2018 Perlite-An Effective Soilless Substrate for Producing Strawberry Plants Free from Nematode Transmitted Viruses;7(03).
5. Foidl N, Makkar HPS, Becker K. The Potential of *Moringa oleifera* for agricultural and industrial uses October 20th, November 2nd 2001. Dar Es Salaam; 2001.
6. Fuglie LJ. New uses of Moringa Studied in Nicaragua. ECHO Development Notes. 2000;68.
7. Jadav RG, Patel HC, Masu MM, Sitapara HH, Parmar AB, Patel HD. Fertilizer requirements of drumstick cv. PKM-1. Int J Agric Sci. 2010;6(1):220-5.

8. Jaya S, Sunita A. Impact of organic fertilizers on growth, yield and quality of spinach. Indian J Plant Sci. 2017;39(27).
9. Ramachandran C, Peter KV, Gopalakrishnan PK. Drumstick (*Moringa oleifera*): A multipurpose Indian vegetable. Econ Bot. 1980;34(3):276-83.
10. Perur NG, Subramanaim CK, Mukhar GR, Roy HF. Soil fertility evaluation serve Indian farmer deptt. Agriculture (Mysore) and university of Agricultural Science Banglore; 1973.
11. Prakash V, Kavitha JR, Kamaleshwaran R, Prabharan P, Alagendran S. Effect of coir pith compost in agriculture. J Med Plants Stud. 2021;9(4):106-10.
12. Sakthivigneswari G, Vijayalakshmi A. Bocompost as soil supplement to improve vegetative growth and yield of *Solanum nigrum* (L.). World J Pharm Pharm Sci. 2016;5(3):753-62.
13. Vishakha P, Shilva D, Dubey YP. Effect of Vermicompost and P Enriched Biocompost on Soil Properties under French bean Crop. Int J Curr Microbiol Appl Sci ISSN: 2319-7706; 2018.
14. Walkely A, Black GA. Critical exam of rapid method for determining organic carbon in soils, effect of variation in digestive condition and inorganic soil constituents soil science. 1956;251: 632.
15. Wasim HR, Kumawat KL, Sharma OC, Anil Sharma M, JI, Sajad N et al. Effect of different substrates on growth and quality of Strawberry cv. chandler in soilless culture. The Pharm Innov J. 2018;7(12): 449-53.
16. Fisher RA. The correlation among relatives on the supposition of mendelia inheritance. Aust J Agric Res. 1950; 14:742-57.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/90570