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Response of physiological and biotic stress susceptibility 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 physiological parameters and biotic stress susceptibility as influenced by different varieties and media's. The work on the entitled topic viz.; Response of physiological and biotic stress susceptibility for the most ideal soil media of different varieties of drumstick (*Moringa oleifera* L) under net house condition has not been reported in the malwa region.. Therefore, the specific studies were conducted in net house condition. 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. Bhagalaxmi and local in combination with six different potting media's viz. V1T1 (Bhagalaxmi with only soil 100 percent), V2T2 (Bhagalaxmi with only sand 100 percent), V1T3 (Bhagalaxmi with soil+ cocopeat 3:1), V1T4 (Bhagalaxmi with soil+ FYM3:1), V1T5 (Bhagalaxmi with soil+Poultrymanure3:1), V1T6 (Bhagalaxmi with soil+vermicompost3:1), V2T1 (Local with only soil 100 percent), V2 T2 (Local with only sand 100 percent) V2T3 (Local+soil+cocopeat3:1), V2T4 (Local+soil+FYM3:1), V2T5 (Local+soil+poultrymanure3:1), V2T6 (Local+soil+ vermicompost 3:1). The treatment V1T6 (Bhagalaxmi +soil + vermicompost 3:1) resulted superior in terms of physiological parameters as compared to rest of the treatments in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM) However, treatment V2T2 (Local+ only sand) was found to be lowest in leaf area index. The maximum biotic stress susceptibility was recorded in the treatment V2T2 (Local+ only sand) in terms of varietal effect, effect of soil media and interaction between varieties and media (VXM). While minimum was recorded in treatment V1T5 (Bhagalaxmi +soil + Poultry manure 3:1).

Keywords: Drumstick, vermicompost, FYM cocopeat poultry manure sand soil, seedlings, leaf area index, insect pest incidence, nutrient composition

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 fastgrowing, 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) [1]. 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 (Hartwell, 1995) [6]. More than three hundred diseases including cancer, diabetes and high blood pressure can be controlled or cured by *M. oleifera* (Anon. 2009) [4]. Its seeds are used for purifying water in some African countries (Suarez *et al.* 2003) [8]. 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). 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). (Stoffella *et al.* 1997) [10] 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 plant physiological enlargement 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) [2]. 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. Organic base fertilizer such as organomineral fertilizer improves soil structure, reduces erosion, lowers the temperature at the soil surface, and increases soil water holding capacity. The use of NPK fertilizer has resulted in the improvement of the growth and yield of crops. Due to increasing demand of moringa for biofuel and medicinal uses, it is therefore necessary to investigate ways to improve its growth in degraded soil. (Stoffella *et al.* 1997) [10] 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 present investigation entitled "Response of nutrition composition, physiological and biotic stress susceptibility 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 Bhagyalaxmi 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 = Bhagyalaxmi with Only Soil 100% V1T2 = Bhagyalaxmi with Only Sand 100% 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% 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, s and, FYM, Poultrymanure, Cocopeat, Vermicom post 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 polybags were sterilized with thermal @2g/m2 respectively. The different soil media of the experiment was comprised with different amount of NPK Status which has been analyzed and formulated accordingly. The status of these samples may have different composition of above parameters in next year and so on as the mineralization of nutrients increases with the decomposition

of organic inputs like cocopeat, vermicompost, FYM and poultry manures. In terms of physiological parameters LAI provided meaningful growth analysis in moringa crop. The ratio of leaf area to ground area was estimated to determine leaf area index. It was recorded after fifty percent development of plant up to the height of 20 – 25 cm. it was calculated with the given formula i.e.

$$LAI = \frac{\text{Leaf area (cm}^2\text{)}}{\text{Ground area (cm}^2\text{)}}$$

The observation for diseases and pest incidence population per leaf was counted in the early morning hours at an interval of 07 days from three observational plants of each treatments starting from fifteen days from date of sowing. Observation by taking three leaves per plant at random (two each from top and middle and one from bottom) Leaf eating caterpillar *Noorda blitealis* earlier considered as a minor pest usually infests the crops the leaves appear papery and get dried. Pest Incidence was recorded at thirty days of sowing. The Pest incidence and severity was studied with the following given formula i.e.

$$\text{Pest (Leaf eating caterpillar) incidence} = \frac{\text{Number of pest (leaf eating caterpillar) affected plant}}{\text{Total number of sampled plant}} \times 100$$

The data were subjected to analysis of variance (ANOVA)

Results and discussion

Effect of varieties and soil media- Bhagyalaxmi (V1) and local (V2) on Physiological parameters

The significantly maximum leaf area index was observed under the variety V1 Bhagyalaxmi (6.38) while the variety V2 Local shown comparatively less leaf area index (5.75). Soil media significantly influenced the leaf area index of drumstick plants. Maximum leaf area index was observed in the soil media T6 (soil + vermicompost 3:1) (8.91) followed by T5 (soil + poultry manure 3:1) (7.55). However, the minimum was recorded in soil media T2 (only sand 100 percent) (3.42) followed by T1 (only soil 100 percent 3:1) (4.19). The leaf area index was significantly influenced by the varietal effect in variety V1 Bhagyalaxmi has recorded maximum leaf area index and minimum was found in variety V2 Local respectively. The soil media also found to be significant in terms of leaf area index. It was observed that maximum leaf area index was recorded in soil media T6 (Soil+ vermicompost 3:1) and minimum was recorded in T2 (only sand 100 percent). The observed results probably be due to improvement in the physio- chemical properties of the medium which increases the enzymatic activity, nutritional factors and plant growth regulators Arancon *et al.* (2004) due to vermicompost used as a potting media. Similar results was observed with Azarmi *et al.* (2008) [3] in Tomato. However in contrast to these results Lere *et al.* (2015) showed maximum leaf area index was observed in sand potted with top soil in moringa under nursery.

Effect of Interaction (Variety and soil media)

The Interaction between variety and media shown non significant effect on leaf area index. Treatment combination V1T6 (Bhagyalaxmi + soil + vermicompost 3:1) shown maximum leaf area index (9.27) followed by V2T6 (local + soil + vermicompost 3:1) (8.54). However, minimum leaf area index was recorded in the treatment V2T2 (Local + only sand 100 percent) (3.07) followed by treatment V1T2 (Bhagyalaxmi + only sand 100 percent) (3.77).

Response of variety, soil and its interaction on leaf area index of drumstick

Variety /Treatment	V1Bhagalaxmi	V2 Local	Mean
T ₁ (Only Soil 100%)	4.28	4.11	4.19
T ₂ (Only Sand 100%)	3.77	3.07	3.42
T ₃ (Soil + Cocopeat 3:1)	6.52	5.34	5.93
T ₄ (Soil + FYM 3:1)	6.56	6.22	6.39
T ₅ (Soil + Poultry Manure 3:1)	7.86	7.24	7.55
T ₆ (Soil + Vermicompost 3:1)	9.27	8.54	8.91
Mean	6.38	5.75	6.06
SEm± (V)	0.06		
CD at (5%) (V)	0.18		
SEm± (M)	0.11		
CD at (5%) (M)	0.32		
SEm± (V X M)	0.15		
CD at (5%) (V X M)	NS		

Effect of varieties and soil media- Bhagalaxmi (V1) and local (V2) on Biological parameters.

Biotic stress susceptibility

Incidence of disease (%)

During the period of investigation in the net house, no disease incidence was found and each plants were seen healthy and disease free.

Incidence of pest (%)

The leaf area caterpillar was observed during 30 DAS. The variety V2- Local exhibited more pest infestation (17.80 percent) as compared to the variety V1- Bhagalaxmi (13.40 percent). In case of soil media treatment T2 (only sand 100 percent) was severally infested with (38.30 percent) leaf caterpillar. While least affected plants were observed in the media T5 (8.50percent) in incidence of pest percent. The pest incidence was not significantly affected with interaction of (VXM). However, Maximum pest incidence (40.00 percent) was observed in the treatment combination V2T2 (local + only sand 100 percent) followed by V1T2 (Bhagalaxmi + only sand 100 percent) (36.70 percent). While, minimum was observed in the treatment combination V1T5 (Bhagalaxmi +soil poultry manure 3:1) (3.30 percent) followed by V1T6 (Bhagalaxmi + soil + vermicompost 3:1) (6.70 percent) in case of leaf caterpillar, the variety V2- Local exhibited more disease incidence as compared to the variety V1- Bhagalaxmi. In soil media treatment T2 (only sand 100 percent) was severally infested with While least affected plants were observed in the treatment T5 in incidence of pest percent. The pest incidence was not significantly affected with interaction of variety and media. However, Maximum pest incidence was observed in the treatment combination V2T2 (local + only sand 100 percent) followed by treatment combination V1T2 (Bhagalaxmi + only sand 100 percent) While, minimum pest incidence was observed in the treatment combination V1T5 (Bhagalaxmi +soil poultry manure 3:1) followed by V1T6 (Bhagalaxmi + soil + vermicompost 3:1). The favourable results was may be because the use of poultry manure did not only enhance the nutrient status of the soil and consequently vegetative growth of the plants but also not significantly affect yields. This was due to the phenomenon of tolerance the substances known to influence pest activity include amino acids, sugars, enzymes, phenols and alkaloids (Palaniapan and Annadurai, 1999) [7]. When nutrients are made available to crop plants in required quantities, they aid in the formation of these substances that impart resistance/tolerance to insect pests. The use of poultry manure should be encouraged to achieve substantial reduction in pest numbers and improve yield since chemical insecticide

application and the use of artificial fertilizer might not be the option for the average resource-poor farmer (Baidoo and Mochiah 2011). Similar results were obtained from (Baidoo and Mochiah 2011) in okra however, the results disagreed with (Sujit Adhikary, 2012) where vermicompost was found better in controlling the insect pest incidence of leaf caterpillar in tomato.

Response of variety, soil and its interaction on Insect and Pest incidences

Variety /Treatment	V1 Bhagalaxmi	V2 Local	Mean
T ₁ (Only Soil 100%)	10.3(18.8)	13.3(21.4)	11.8(20.1)
T ₂ (Only Sand 100%)	36.7(37.3)	40(39.2)	38.3(38.3)
T ₃ (Soil + Cocopeat 3:1)	6.7(15.0)	20(26.6)	13.3(24.2)
T ₄ (Soil + FYM 3:1)	13.7(21.7)	20(26.6)	16.8(24.2)
T ₅ (Soil + Poultry anure 3:1)	3.3(10.5)	6.7(15.0)	5(12.9)
T ₆ (Soil + ermicompost 3:1)	6.7(15.0)	10.3(18.8)	8.5(17.0)
Mean	13.4(21.5)	17.8(25.0)	15.6(23.3)
SEm± (V)	2.47		
CD at (5%) (V)	NS		
SEm± (M)	4.28		
CD at (5%) (M)	12.47		
SEm± (V X M)	6.05		
CD at (5%) (V X M)	NS		

Severity Scale

Variety /Treatment	V1 Bhagalaxmi	V2 Local	Mean
T ₁ (Only Soil 100%)	1	1	1
T ₂ (Only Sand 100%)	4	4	4
T ₃ (Soil + Cocopeat 3:1)	1	2	1
T ₄ (Soil + FYM 3:1)	1	2	2
T ₅ (Soil + Poultry Manure 3:1)	1	1	1
T ₆ (Soil + Vermicompost 3:1)	1	1	1
Mean	1	2	2

Conclusion

From the forgoing investigation, it can be concluded that among the two different varieties of Moringa variety V1- Bhagalaxmi performed best with respect to leaf area index when compared to variety V2 – Local. The variety V2 Local was poorest for all parameters except in incidence of pest percent. In case of different soil media's T6 (soil + vermicompost 3:1) responded with superior results in leaf area index while soil media T5 (soil+ only sand 100 percent) performed with minimum results except in incidence of pest percent. As far as the interaction effect is concerned between variety and media (VXM) the treatment combination V1T6 (Bhagalaxmi+ soil+ vermicompost 3:1) maximum results in physiological parameters, while treatment combination V2T2 (Local+ only sand 100 percent) recorded with minimum

results in terms of all the parameters except in incidence of pest percent.

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