Research Article

Effect of Growing Media Mixtures on Seed Germination and Seedling Growth of Different Mango (*Mangifera indica* L.) Cultivars under Submountaineous Conditions of Punjab

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Abstract

The present investigation entitled "Effect of growing media mixtures on seed germination and seedling growth of different mango (*Mangifera indica* L.) cultivars under submountaineous conditions of Punjab" was conducted at Punjab Agricultural University, Regional Research Station, Gurdaspur during the years 2015-16 and 2016-17. Fully ripened mango fruits stones were collected from healthy and disease free plants of Dusehri, Amrapali and Alphonso cultivars and sown in the month of August in polythene bags containing different soil potting mixture treatments comprising of Soil+Sand+Farmyard manure (FYM) (1:1:1), Soil+Sand+Vermicompost (1:1:1), Soil+Sand+FYM (2:1:1), Soil+Sand+Vermicompost (2:1:1), Soil+ Sand+FYM (1:2:1), Soil+ Sand+Vermicompost (1:2:1), Soil+Sand+FYM (1:1:2), Soil+Sand+Vermicompost (1:1:2) and Soil (control). It was noted that among the different growing media, Soil + Sand + Vermicompost (1 : 1 : 2) was found to be most effective for better germination of mango stones as well as growth of mango seedlings in terms of minimum number of days taken to seed germination with highest germination (%), survival (%), seedling height (cm), number of leaves, seedling girth (mm), number of roots, tap root length (cm), root girth (mm), fresh weight of seedling (gm), dry weight of seedling (gm), root fresh weight (gm) and root dry weight (gm). Similarly among the cultivars tested, Dusehri found better for the above parameters. Hence, Dusehri mango stones sown in Soil+Sand+ Vermicompost (1:1:2) growing media in polythene bags in the month of August was found to be most suitable for raising the healthy rootstock for production of good quality grafted nursery plants of mango.

Keywords: Cultivars, Growing media, Mango, Seed germination, Seedling growth, Submountaineous conditions

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Introduction

Mango (*Mangifera indica* L.) is a tropical fruit and also known as 'king of fruits' belongs to genus Mangifera, family Anacardiaceae which is grown almost all parts of the world. This genus had its origin in the continental region of Burma, Thailand, Indo-China and Malaysia peninsula as reported by [1]. In India, it is cultivated at sub-continent for well over 4000 years. Mangoes possessing the pride position in tropical and subtropical region, between 23° North and South latitude. It is a national fruit of India because of its delicious taste, excellent flavour/aroma, attractive colour and its fruit contains 0.6% protein, fair amount of carbohydrates (11.8%), minerals like calcium, phosphorous and iron (0.3%). Its fruit is richest source of vitamin A (4800units), B_1andB_2 (90mg) and vitamin C (13mg) per 100gm of pulp. India is the largest producer of mango and occupying an area of 2516 thousand hectares with an annual production of 18431 thousand metric tonnes [2]. It is extensively cultivated in Punjab, Haryana, Uttar Pradesh, Gujarat, Rajasthan, West Bengal, Maharashtra, Orissa, Andhra Pradesh, Karnataka and Tamil Nadu states of India. In Punjab, it is mainly growing in submountaineous zones with an area of 6744 hactares with 119322 metric tonnes production [3]. Mango plants are multiplied through grafting and each plant is made up of two parts; the rootstock, providing root system and the scion forming the tree canopy. Both of these parts play an equally vital role in the life of a tree. The rootstock has great influence on the vigour, longevity and productivity of the scion variety. Even the quality and composition of fruits also have been affected by it. A stock is called "seedling root stock" if it is grown from seed and "clonal root stock" if it is grown from vegetative propagation. Nursery potting medium is most important input for healthy, uniform and quality rootstock seedling production. Apart from the selection of proper ingredients, it is also necessary to maintain the porosity of the potting mixture so that proper development of roots takes place [4]. Growing media is the important input for the containerized seedling production. It is characterized by light weight, friable, good water holding capacity, drainage, porosity and low bulk density etc. [5]. The production of planting stock of superior quality is the pre-requisite for plantation of an orchard. Therefore, the seedlings raised on

good quality nursery media will ensure better establishment and growth when planted to the main field. The potting mixture should have enough nutrients, good water holding capacity and drainage to ensure better growth of seedlings [6]. Now a days, there is necessity of reducing the production cost of planting stock by utilizing locally available material for raising quality nursery plants. Vermicompost is commonly used as plant growth media and soil amendments. Vemicompost is a product of a non-thermophilic bio-degradation of organic materials through interactions between earthworms and microorganisms. As compared to conventional compost, vermicompost have accelerated bio-oxidation of organic matter which is achieved mostly by high density earthworms populations [7] and [8]. Vermicomposts are finely divided peat-like materials with high porosity, aeration, drainage and water holding capacity [9]. Vermicompost significantly reduced bulk density and increased porosity of soils [10]. Vermicompost can be used as a potting mixture for horticultural crops. Therefore, the present study was conducted to ascertain the effect of growing media mixtures on seed germination and seedling growth of different mango (*Mangifera indica* L.) cultivars under submountaineous conditions of Punjab.

Materials and Methods

The present investigation was conducted at Punjab Agricultural University, Regional Research Station, Gurdaspur during the years 2015-16 and 2016-17. Fully ripened mango fruits from healthy and disease free plants of Dusehri, Amrapali and Alphonso cultivar were collected and their stones were extracted and sown in the month of August in polythene bags (40cmx25cm size and 150-200gauge thickness) containing different soil potting mixture treatments comprising of Soil+ Sand+ Farmyard manure (FYM) (1:1:1), Soil + Sand + Vermicompost (1:1:1), Soil + Sand + FYM (2:1:1), Soil + Sand + Vermicompost (2:1:1), Soil+ Sand + FYM (1:2:1), Soil + Sand + Vermicompost (1:2:1), Soil + Sand + FYM (1:1:2), Soil + Sand + Vermicompost (1:1:2) and Soil (control) . The experiment was laid in Randomized Block Design (RBD) as described by [11] and all the treatments were replicated in thrice. The data on number of days taken to seed germination, germination percentage, survival percentage, seedling height (cm), number of leaves, seedling girth (mm), number of roots, tap root length (cm), root girth (mm), fresh weight of seedling (gm), dry weight of seedling (gm), root fresh weight (gm) and root dry weight (gm) were recorded.

Results and Discussion

Days Taken to Germination and Germination Percentage

Table1 indicated that Soil + Sand + Vermicompost (1:1:2) medium, the mango stones were taken the minimum days (15.52) to germination as well as maximum germination (95.50%) while in case of cultivars, minimum days (16.12) required to germinate and maximum germination (93.26%) of mango stones were noted in Dusehri. Vermicompost is high in organic matter which increases water and nutrient holding capacity of the medium for supply to the plant. Vermicompost is reported as having bioactive principles considered to be beneficial for root growth, root initiation, germination and growth of the plant [12], as also having a balanced composition of nutrients [13]. Organic matter present in the vermicompost may also improve nutrient availability and improve phosphorus absorption [14]. All these factors are favourable for seed germination and ultimately, increase seed germination percentage, speed of emergence and seedling vigour.

Seedling Height

The highest height of seedling (68.55cm) was recorded in Soil+ Sand+Vermicompost (1:1:2) medium and among different cultivars, Dusehri recorded significantly the maximum plant height (65.25cm) as shown in Table 1 and Figure 1. Minimum seedling height was observed in soil as control media (Table 1 and Figure 2). Nutrients in vermicompost are present in readily available forms for plant uptake e.g. nitrates, exchangeable P, K, Ca and Mg [9]. [15] also reported maximum plant height of tomato with vermicompost application. Similar trend was noticed in onion and potato crops. Vermicompost are comprised of large amounts of humic substances, some of the effects of which on plant growth are similar to those of soil-applied plant growth regulators [16]. Vermicompost as potting mixture for cardamom seedlings had significantly increased the height of plants [17]. [18] recorded 30% increased in plant height in turmeric varieties *viz*., Armoor and Suroma over control when grown with vermicompost.

Number of Leaves and Seedling Girth

Similarly, Soil + Sand + Vermicompost (1:1:2) medium produced significantly maximum number of leaves per plant (32.50) with highest plant girth (11.15mm) while among various cultivars, Dusehri recorded significantly the

maximum number of leaves per plant (30) with highest plant girth (10mm) as shown in Table 1 and Figure 2. It may be due to better nutrient availability leading to higher production of photo synthetically functional leaves and better girth of the seedlings due to growing media [19]. Minimum number of leaves and seedling height were observed in soil as control (Table 1 and Figure 2).

Table 1 Effect of different growing media on number of days taken to seed germination, germination percentage, survival percentage, seedling height, number of leaves and seedling girth of different mango cultivars

Growing media	Number of days taken to seed germination	Germination (%)	Survival (%)	Seedling height (cm)	Number of leaves	Seedling girth (mm)
Soil+Sand+FYM (1:1:1)	23.33	55.85	51.26	48.15	18.15	5.51
Soil+Sand:+Vermicompost (1:1:1)	21.10	75.51	70.43	55.51	24.25	7.25
Soil+Sand+ FYM (2:1:1)	24.50	50.55	46.11	42.12	16.10	5.00
Soil+Sand+Vermicompost (2:1:1)	22.13	68.32	63.16	50.51	22.00	6.50
Soil+Sand+FYM (1:2:1)	25.43	45.74	41.45	39.00	14.00	4.45
Soil+Sand+Vermicompost (1:2:1)	20.12	80.45	76.35	58.50	26.22	7.50
Soil+Sand+FYM (1:1:2)	22.50	60.61	55.40	51.25	20.15	6.00
Soil+Sand+Vermicompost (1:1:2)	15.52	95.50	85.25	68.55	32.50	11.15
Soil (control)	30.57	40.43	35.15	32.52	12.00	5.25
CD (5%)	1.74	2.87	2.48	3.27	2.14	2.07
Cultivar						
Dusehri	16.12	93.26	80.55	65.25	30.00	10.00
Amrapali	20.25	80.52	72.56	58.12	26.25	8.25
Alphonso	24.21	72.33	66.52	50.33	22.15	6.10
CD (5%)	3.38	2.74	5.35	2.31	0.09	2.42

Figure 1 Dusehri mango stones grown in Sand+Sand+Vemicompost(1:1:2) media

Figure 2 Mango stones grown in soil (control) media

Seedling Survival, Number of Roots, Tap Root Length, Root Girth, Root Fresh Weight (gm), Root Dry Weight, Fresh Weight and Dry Weight of Seedlings

Table 1 and Table 2 showed that maximum seedling survival (85.25%), number of roots (50.25), tap root length (30.15cm), root girth (5.5mm), root fresh weight (13.52gm) and dry weight (8.45 gm) were recorded in Soil + Sand+ Vermicompost (1:1:2) medium. Among cultivars, Dusehri recorded maximum seedling survival (80.55%), number of roots (48.26), tap root length (28.22cm), root girth (5.2mm), root fresh (12.75gm) and dry weight (8.24gm). [20] also noted that the sprout vigour of rooted vanilla cuttings grown in vermicompost media in terms of number of sprouts, sprouts lengths, number of leaves/vine, leaf area/vine, number of roots and root length were found to be best. Better rooting was associated with better survival rate in *Prunus cerasus* [21] and in peach cultivar Fertilia [22]. The logical conclusion seems that large numbers of roots are associated with adequate nutrient absorption which account for ultimate survival. There is a strong correlation between number of roots and survival of plants [23]. Similarly, higher fresh weight (33.65gm) and dry weight (25.52gm) of the seedlings were observed in Soil: Sand: Vermicompost (1:1:2) medium (Table 2) due the better vegetative growth. Similarly, among various cultivars, Dusehri recorded significantly the maximum fresh weight (32.50gm) and dry weight (24.35gm) of seedlings. This may be due to favourable medium for better growth of the seedling, particularly for good development of root system. These results are in close agreement with [24].

Table 2 Effect of different growing media on number of roots, tap root length, root girth, seedling fresh weight, seedling dry weight, root fresh weight and root dry weight of different mango cultivars

Growing media	Number of roots	Tap root length (cm)	Root girth (mm)	Fresh weight of seedling (gm)	Dry weight of seedling (gm)	Root fresh weight (gm)	Root dry weight (gm)
Soil+Sand+FYM (1:1:1)	21.24	15.20	3.65	19.25	11.36	6.10	3.50
Soil+Sand+Vermicompost (1:1:1)	35.55	20.24	4.60	26.14	18.24	9.00	5.00
Soil+Sand+FYM (2:1:1)	16.50	13.45	3.45	17.16	9.15	5.75	3.25
Soil+Sand+Vermicompost (2:1:1)	30.12	18.50	4.35	23.25	15.14	7.11	4.45
Soil+Sand+FYM (1:2:1)	13.52	12.00	3.25	15.26	8.12	5.00	3.00
Soil+Sand+Vermicompost (1:2:1)	42.26	22.11	5.00	26.16	20.35	11.15	7.51
Soil+Sand+FYM (1:1:2)	25.23	17.12	4.00	21.35	13.50	6.51	4.00
Soil+Sand+Vermicompost (1:1:2)	50.25	30.15	5.50	33.65	25.52	13.52	8.45
Soil (control)	10.35	9.50	3.00	13.50	6.15	4.51	1.50
CD (5%)	2.09	3.22	1.56	1.58	2.92	2.03	1.66
Cultivar							
Dusehri	48.26	28.22	5.20	32.50	24.35	12.75	8.24
Amrapali	40.48	23.46	4.55	27.21	21.50	10.45	6.52
Alphonso	31.25	18.52	4.10	24.50	18.00	9.52	4.75
CD (5%)	1.39	0.08	NS	4.54	0.12	0.16	1.36

Conclusion

From the present study, It was concluded that Dusehri mango stones sown in Soil + Sand + Vermicompost (1:1:2) growing media recorded minimum number of days taken to seed germination with highest germination percentage, survival percentage, seedling height (cm), number of leaves, seedling girth (cm), number of roots, tap root length (cm), root girth (mm), fresh weight of seedling(gm), dry weight of seedling(gm), root fresh weight (gm)and root dry weight(gm). Therefore, fully ripened Dusehri mango stones sown in the month of August in polythene bags containing Soil + Sand + Vermicompost (1:1:2) growing media can be successfully used as rootstock for raising the healthy grafted nursery plants of mango.

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