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Research Journal of Agricultural Sciences **14**(6): 1855–1858 (Nov-Dec 2023)
DOI: http://rjas.org/Article/Article/5697

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

Effect of Organic Media on Growth and Rooting Performance of Medicinal Plants

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Received: 11 Sep 2023; Revised accepted: 12 Nov 2023; Published online: 04 Dec 2023

Abstract

Growth and rooting performance of medicinal plants with different organic growing media was carried out in factorial completely randomized design (FCRD) with five treatments and three replications. The growing media includes vermicompost, red soil, cocopeat, sand and sawdust. The medicinal plants like Medicinal Coleus and Kesavardhini plants cuttings were used in this experiment. The experiment revealed that the cuttings of Medicinal Coleus and Kesavardhini plants planted under vermicompost media showed best result in respect of vegetative and root characters like days taken for sprouting (9.23 and 7.95), number of shoots (9.84 and 5.62), shoot length (21.21 cm and 21.36 cm), number of leaves (90.21 and 28.34), leaf length (4.67 cm and 4.84 cm), leaf breadth (2.63 cm and 3.16 cm), root length (17.95 cm and 33.25 cm), number of roots (7.52 and 8.81) and chlorophyll content (26.24 mg/m2 and 33.25 mg/m^2) respectively. The experiment concluded that the medicinal plants like Medicinal Coleus and Kesavardhini cuttings planted in vermicompost media give quality plants for commercial multiplication.

***Key words*:** Organic media, Medicinal coleus, Kesavardhini, Rooting, Growth

The medicinal and herbal industry is erupting day-by-day and its leads to more demand on medicinal and herbal plants. Due to the increasing herbal industry for a variety of nutritional supplements, cosmetic items, and herbal health care formulations, there is an increase in the demand for the medicinal plant in the industry. To meet the needs of demands, the only way is to a large production, however, there are difficulties right when the seeds are planted. The unavailability of seed materials, short viability and storage increases the demand. If seeds are accessible in some plants, vegetative propagated material is still required for high-quality, vigorous growth and uniform yield.

Medicinal Coleus (*Coleus forskohlii*) (Poir.) Briq. (Pathachur, Galbel) is an important medicinal plant that belongs to the family of Lamiaceae. The plant is thought to have originated in India [1]. Its roots contain forskolin, also known as coleonol, which is used as a medication to treat hypertension, glaucoma, asthma, congestive heart failure, and some types of cancer. It was designated as an endangered species because wild roots were being continuously collected. Cultivation of Coleus forskohlii is increasing due to its economic potential, with an estimated yearly production of roughly 100 tonnes from 700 ha in India [2]. Kesavardhini (*Centratherum punctatum*) is a member of the Asteraceae. The plant contains phenolic chemicals, sesquiterpene lactones, flavones, glycosides, and a variety of flavones. It is valued as a medicinal plant, since it is useful against a variety of illnesses, while being grown for its decorative features in subtropical and warm temperate countries [3]. Vegetative propagation is the most crucial method for the clonal regeneration of many horticultural crops, including ornamentals, fruits, nuts, and vegetables [4]. Successful cutting propagation requires adventitious root development. The rooting media is crucial for achieving this goal. In addition to keeping the cutting in place, the medium must give the cutting base the right amount of moisture while allowing for aeration. Given these presumptions, it is clear that there is no perfect rooting media for cutting propagation because the needs vary according to the species, kind of cutting, season, and technology available. Medicinal Coleus and Kesavardhini is commercially propagated by cutting, but the rooting performance are poor due to the media proposition used for rooting and growth of plants. Hence, standardization of rooting media for multiplication of both the medicinal plants was undertaken.

MATERIALS AND METHODS

The present investigation was carried out in the Department of Medicinal and Aromatic Crops, Adhiparasakthi Horticultural College. The experiment was carried out in factorial completely randomized design (FCRD) with three replications and two factors: Growing media and Medicinal plants. The first factor is comprised of five treatments, viz., vermicompost, red soil, cocopeat, sand and sawdust. The second factor contains two treatments, viz., Medicinal Coleus (P_1) and Kesavardhini (P_2). The growth media like vermicompost, soil, cocopeat are obtained from the department

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Citation: Kumaresan M, Devi KN, Rajaselvam M. 2023. Effect of organic media on growth and rooting performance of medicinal plants. *Res. Jr. Agril. Sci.* 14(6): 1855-1858.

unit of horticulture. Sawdust was collected from the nearby sawmill. Sand is collected from Palar River. These media are given as per the treatments in individual pots. The fresh cuttings of Medicinal Coleus and Kesavardhini were collected from the Herbal Garden, which is located at Adhiparasakthi Horticultural College. The length of 10-15 cm fully mature cuttings with 3-4 nodes without leaves was taken. Each cutting was trimmed vertically, with a transverse cut at the top and a slant cut at the basal end. All cuttings were kept in a low-cost polytunnel with frequent watering. The temperature in the tunnel was kept at 30±2 °C and the relative humidity at > 85%. The observations were recorded on various shoot and root parameters such as days taken for sprouting, number of shoots, shoot length, number of leaves, leaf length, leaf breadth, root length and number of roots. The chlorophyll content is measured by using the chlorophyll SPAD meter. Data pertaining to various vegetative characters and physiological characters were tabulated and statistically analyzed using factorial completely randomized design (FCRD). The inference was drawn after comparing the calculated F values with the tabulated F values at 5% (P= 0.05) level of significance.

RESULTS AND DISCUSSION

Days taken for sprouting

It was observed that the days taken for sprouting (Table 1) recorded least 9.23 days in the cuttings were planted in the rooting media of vermicompost (T_3) and maximum days absorbed in the cuttings are planted in the rooting media of red soil (16.42) (T_2) in medicinal Coleus. In case of Kesavardhini, the cuttings were planted at the rooting media of vermicompost (T_3) recorded least days taken for sprouting (7.95) and maximum days absorbed in the cuttings are planted in the rooting media of red soil (16.35) (T_2). Least days taken for sprouting in vermicompost may be due to the presence of more nutrients compared to the other media tested. Maximum days taken for sprouting in red soil may be due to the characters of high-water stagnation that lads to delay the sprouting. The result is in compliance with Sharath and Bhoomika [5], who said that vermicompost may be a reliable source of plant growth regulators, made by earthworms and microorganisms interacting, which may greatly improve plant growth. The result is in agreement with Wahab *et al.* [6] in guava.

Number of shoot and shoot length

The data pertaining to the number of shoots and shoot length per cutting is presented in (Table 1), among the media used, the cuttings were planted in the media of vermicompost (T_3) showed maximum number (9.84 and 5.62) of shoots and shoot length (21.21 and 21.36) respectively. The lowest number of shoots and shoot length (14.21 and 12.36) was observed in red soil (T_2) (6.10 and 4.21) in medicinal coleus and Kesavardhini. These results may be due to the supplementary availability of major nutrients in vermicompost. Presence of macronutrients in vermicompost enhances the shoot growth by cell division and elongation. Vermicompost is a highly effective growing medium for plants, exhibiting enhanced growth in numerous plant species [7-8]. Similar findings were reported by Nawarathna *et al.* [9] as they investigated the rooting and survivorship capabilities of various *Momordica dioica* cutting varieties in various rooting substrates and reported that the vermicompost showed maximum shoots and length. Diese outcome was consistent with the findings by Bhadwaj [10] in seedling growth of papaya cv' Red Lady', Vo and Wang [11] in muskmelon (*Cucumis melo* L.) and Pham and Nguyen [12] in rosemary (*Rosmarinus offcinalis* L.).

Table 1 Effect of organic media on days taken for sprouting, number of shoots and shoot length (cm) of medicinal plants

Treatments	Days taken for sprouting		Number of shoots		Shoot length (cm)	
	P_1	P_2	P_1	P_2	P_1	P_2
T_1: Cocopeat	12.58	10.74	6.26	2.51	17.21	15.36
T_2: Red soil	16.42	16.35	6.10	4.21	14.21	12.36
T_3: Vermicompost	9.23	7.95	9.84	5.62	21.21	21.36
T_4: Sand	10.84	14.42	5.75	3.86	15.21	16.36
T_5: Saw dust	12.45	11.25	7.23	4.71	17.21	19.36
Mean	12.304	12.142	7.036	4.182	17.01	16.96
SEd	0.357	0.357	0.380	0.311	0.527	0.425
CD (P=0.05)	0.714	0.714	0.761	0.623	0.984	0.854

Table 2 Effect of organic media on number of leaves, leaf length (cm) and leaf breadth (cm) of medicinal plants

Treatments	Number of leaves		Leaf length (cm)		Leaf breadth (cm)	
	P_1	P_2	P_1	P_2	P_1	P_2
T_1: Cocopeat	18.84	18.48	2.51	4.01	2.37	3.08
T_2: Red soil	10.54	7.25	3.12	2.08	1.38	1.44
T_3: Vermicompost	90.21	28.34	4.67	4.84	2.63	3.16
T_4: Sand	42.35	16.78	3.23	2.52	1.41	1.62
T_5: Saw dust	19.25	6.21	2.84	2.91	1.85	2.01
Mean	36.238	15.412	3.274	3.272	1.928	2.262
SEd	0.461	0.312	0.491	0.491	0.262	0.313
CD (P=0.05)	0.923	0.624	0.983	0.983	0.524	0.627

Number of leaves

The result on number of leaves is presented in (Table 2), the maximum number of leaves was found in the cuttings, which were planted in vermicompost (T_3) (90.21 and 28.34) and minimum (10.54 and 7.25) respectively in red soil (T_2) for both the medicinal plants used in this experiment. The higher number

of leaves per cutting in vermicompost treatment may be due to the early in sprouting and the number of shoots and length of shoot. vermicompost's abundant supply of vitamins and growth hormones encourages plant growth [13]. Similar findings reported by Arancon *et al*. [14] and Zaller [15]. Using vermicompost increases the uptake of minerals like phosphorus and nitrogen.

Leaf length and leaf breadth

The result on leaf length and leaf breadth is presented in (Table 2), result revealed that the cutting planted in vermicompost (T_3) showed maximum leaf length (2.51 and 4.01) and leaf breadth (2.37 and 3.08 cm) respectively and minimum leaf length (3.12 and 2.08) and leaf breadth (1.38 and 1.44) respectively in red soil (T_2). A crop with a healthy leaf count will grow and develop more effectively. It has a positive correlation with crop yield as well. More photosynthetic area means more leaves, which could lead to a larger fruit output. Dieses outcome might be the higher potassium, phosphorus, and nitrogen content in vermicompost. According to Mal *et al.* [16] the vermicompost treatment resulted in the highest number of leaves or plants.

Root length (cm) and number of roots

The result on leaf length and leaf breadth is presented in (Table 2), result revealed that the cutting planted in vermicompost (T_3) showed maximum root length (17.95 and 33.25) and number of roots (7.52 and 8.81) respectively and minimum root length (3.25 and 5.56) and number of roots (2.25 and 4.37) respectively observed in red soil (T_2). The increased number of root characters may be due to earliness in sprouting by production or synthesis of more auxin on young growing tips. Similar to the statements given by Barik *et al.* [13], vermicompost is a rich source of macro- and micronutrients, vitamins, growth hormones, and enzymes like lipase, cellulase, proteases, and amylases, which is responsible for better root growth in plants. Vermicompost is most suitable medium for growth of medicinal plants like Coleus and Kesavardhini.

Table 3 Effect of organic media on root length (cm), number of roots and chlorophyll content (mg/m^2) of medicinal plants

Treatments	Root length (cm)		Number of roots		Chlorophyll content (mg/m^2)	
	P_1	P_2	P_1	P_2	P_1	P_2
T_1: Cocopeat	12.35	15.28	3.85	5.42	22.34	12.43
T_2: Red soil	3.25	5.56	2.25	4.37	12.23	5.74
T_3: Vermicompost	17.95	33.25	7.52	8.81	26.24	33.25
T_4: Sand	9.22	23.74	3.35	6.47	22.48	27.42
T_5: Saw dust	16.74	13.57	4.96	6.15	23.31	31.8
Mean	11.902	18.28	4.38	6.24	21.32	22.128
SEd	0.431	0.342	0.250	0.202	0.361	0.402
CD (P=0.05)	0.862	0.684	0.501	0.424	0.722	0.804

Chlorophyll

Chlorophyll content is maximum (26.24 mg/m^2 and 33.25 mg/m^2) in vermicompost (T_3) (Table 3) and minimum (26.24 mg/m^2 and 33.25 mg/m^2) in red soil (T_2) for both the medicinal plants. More availability of nitrogen in the vermicompost may increase the chlorophyll content. Similar results given by Zaller [15]. Vermicompost provided more readily available nitrogen, which raised the level of chlorophyll.

CONCLUSION

The experiment is concluded that the medicinal coleus and Kesavardhini cuttings, planted under vermicompost media, showed a better performance in both vegetative and rooting characters. The vermicompost media is best for commercial multiplication of medicinal Coleus and Kesavardhini, hence recommended to the large-scale growers for better plantation.

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