Effect of Different Growing Media on Growth and Flowering of Petunia (*Petunia hybrida* L.)

Abstract

The Department of Floriculture and Landscape Architecture, COH, Mandsaur, RVSKVV, Gwalior undertook the current study to assess the effectiveness of various growing media on the growth and flowering of petunia (*Petunia hybrida* L.) (M.P.). The experiment had fourteen treatments, three replications, and was set up using a Completely Randomized Design (CRD). Different combinations of cocopeat, FYM, sand, soil and vermicompost were used to create the growth media. In terms of number of branches, flowers per plant, days to blooming, length of flowering, fresh weight of root mass, and dried weight of root mass, data showed that T_{14} [Cocopeat + Sand + Soil + Vermicompost (1:1:1:1)] produced the greatest results. In contrast, T_8 [Sand + Vermicompost (1:1)] outperformed all other treatments in terms of floral diameter, fresh above-ground mass weight, and dry above-ground mass weight. Regarding plant length, number of leaf per plant, and stem diameter, treatment T_2 [vermicompost] has been shown to be superior to other treatments.

Key words: Cocopeat, FYM, Growing media like Soil, Petunia, Sand, Vermicompost,.

1. INTRODUCTION

Petunia (*Petunia spp.*) is an annual or perennial plant belongs to the family Solanaceae. The common kinds are weedy in habit, but their great profusion of bloom under all conditions makes them useful and popular. It is a decorative plant, grown for its beautiful flowers in beddings, borders, pots, hanging baskets, window boxes and containers. The range of flower shape, colour and size are incredible and can be effectively used in different landscape designs and forms. The common flower colours are pink, rose, salmon, red, white, blue bicolours and multicolours. Since the early days of horticulture, petunia is considered to be first cultivated bedding plant and has remained as a commercially vital ornamental crop and is one of the favourite genera for developing new varieties (Farooq *et al*., 2021).

Comment [EP1]: Conclusions are missing! It is necessary to prepare part Conclusions - considering the results, it will not be a problem for the authors.

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Garden petunias are small soft plants having a height of 25-35 cm with straggling or decumbent habit, pubescent and more or less sticky, with large showy flowers. The leaves are alternate, simple and entire, and are viscid pubescent. Flowers are beautiful, funnel shaped, small or large up to 6-12 cm across and produced on about 4-5 cm long flower stalk. Generally petunias are insect pollinated, with the exception of *P. exserta*, which is a rare, red flowered, and humming bird pollinated species.

Soilless media have proven popular with the majority of producers because of consistency, reproductivity, excellent aeration and low bulk density that reduce shipping and handling costs of the medium itself. Cocopeat acceptance as a growing medium is growing because of its superb aeration, lightness, durability and water holding characteristics (Nazari *et al*., 2011).

The product of the composting method using a variety of species of worms generally earthworm to make a heterogeneous mixture of decomposing vegetables or food waste, bedding materials and vermicast is known as vermicompost. It has water-soluble nutrients and is an excellent, nutrient rich organic fertilizer and soil conditioner. It possesses characters like, fertility, water use efficiency, pH, substrate physical properties, microbial activity and organic matter components that may be responsible for increased growth (Padhiyar *et al*., 2017).

Growth mediums are known to have been effective in value adding of potted ornamental plant and should have the best characteristics such as proper aeration, water holding capacity and adequate nutrient supply. Apart from this, growth medium plays a vital part in physiological parameters. It has been reported that the optimum amount of nutrient and environmental factors affect the plant growth, development and flowering of petunia (Khandaker *et al*., 2018).

2. MATERIALS AND METHODS

The present investigation was conducted at the Department of Floriculture and Landscape Architecture, K.N.K. College of Horticulture, Mandsaur, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during 2020-21. The experiment was laid out in a Completely Randomized Design (CRD) with fourteen treatments and three replications. Different growing media like soil, sand, vermicompost, FYM, cocopeat were taken and different

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Comment [EP9]: The composition of the substrates (nutrient content and other relevant parameters) should be listed in the part Materials and Methods.
The ratio of multi-component substrates expresses the mass or volume ratio ?

How many plants was in replication ?
Where plants were grown ("indoor" - greenhouse or "outdoor") ?

Was used irrigation (I assume that yes - growing with use of PE bags)? What type of irrigation was used and what doses?

It should be defined when and how the measurements were made, and how the parameters were measured (for example, how the biomass dry weight was obtained) should be defined.

In part Materials and Methods, the procedures (measurements) must be presented in such a way that the research (experiment) is repeatable.

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combination of media according to the treatment were prepared. These media were filled into the polythene bags. Variants of trial: T_1 (Soil), T_2 (Vermicompost), T_3 (Soil + Sand 1:1)], T_4) (Soil + FYM 1:1), T_5 (Soil + Vermicompost 1:1), T_6 (Soil + Cocopeat 1:1)], T_7 (Sand + FYM 1:1), T_8 (Sand + Vermicompost 1:1), T_9 (Soil + Sand + FYM 1:1:1), T_{10} (Soil + Sand + Vermicompost 1:1:1), T_{11} (Soil + Sand + Cocopeat 1:1:1), T_{12} (Soil + Vermicompost + Cocopeat 1:1:1), T_{13} (Soil + FYM + Cocopeat 1:1:1), T_{14} (Soil + Sand + Vermicompost + Cocopeat 1:1:1:1). Observations parameters like Plant length (cm), Number of leaves per plant, Stem diameter (cm), Number of branches per plant, Number of flowers per plant, Days taken to flowering (days), Flower diameter (cm), Flowering duration (days), Fresh weight of above ground mass (g), Dry weight of above ground mass (g), Fresh weight of root mass (g), Dry weight of root mass (g).

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3. RESULTS AND DISCUSSION

Plant length (cm)

The findings of the present investigation revealed that the maximum plant length at 30 and 45 DAP was observed by the treatment T_2 [Vermicompost] which was significantly different from most of the treatment and the minimum plant length was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of plant length.

Present findings have indicated that potting media composition has a definite role to play in increasing the plant length of petunia. The increase in plant length in T_2 [Vermicompost] provide more nutritive media resulted in increment to plant length. This increase in plant length is due to the ability of this growing media to provide good aeration to plants in order to sustain the development and growth of roots and shoots. Further, vermicompost give maximum growth in account of favourable physiochemical properties of media and nutritional value. It is due to the fact that N is an essential constituent of protein and more availability of N, P and K in the substrate led to increase in cell number and cell size (Padhiyar *et al.*, 2017).

Present findings are in conformity with the findings of Sardoei *et al.* (2014) in marigold and Gupta *et al.* (2014) in marigold.

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Number of leaves per plant

The findings of the present investigation revealed that the maximum number of leaves per plant at 30 and 45 DAP was observed by the treatment T_2 [Vermicompost] which was significantly different from most of the treatment and the minimum number of leaves per plant was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of number of leaves per plant.

The increase in number of leaves could be attributed to the fact that the organic component i.e. vermicompost might have improved the physical structure of the substrate by reducing weight which in turn increases its water holding properties. It also has high cation exchange capacity (CEC) and therefore can store nutrients until required by the plant. All these factors might have contributed to cell multiplication, cell enlargement and differentiation which could have resulted in good photosynthesis and at last the plant exhibited more number of leaves per plant (Devavrata *et al.*, 2020).

Stem diameter (cm)

The findings of the present investigation revealed that the maximum stem diameter at 30 and 45 DAP was observed by the treatment T_2 [Vermicompost] which was significantly different from most of the treatment and the minimum stem diameter was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of stem diameter.

The increase in diameter of stem might be due to the reason that the growing media develop proper aeration, water holding capacity, supplying considerable amount of nutrients all the way through root absorption which converts in photosynthates helps in cell division and cell elongation results in higher stem diameter (Monika *et al.*, 2021). Similar findings have been reported by Sardoei *et al.* (2014) in marigold.

Number of branches per plant

The findings of the present investigation revealed that the maximum number of branches per plant at 30 and 45 DAP was observed by the treatment T_{14} [Soil + Sand + Vermicompost +

Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the minimum number of branches per plant was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of number of branches per plant.

Maximum number of branches per plant might be due to the reason that the potting media in combination might have provided optimal conditions for the better growth, more number of lateral shoots and increase in gibberellin synthesis in plant system consequently resulted in more branches per plant (Kala *et al.*, 2020).

Number of flowers per plant

The findings of the present investigation revealed that the maximum number of flowers per plant was observed by the treatment T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the minimum number of flowers per plant was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of number of flowers per plant.

This might be due to the fact that pH of cocopeat medium is slightly acidic and most of the ornamental crops prefer acidic pH. In cocopeat medium, the exchangeable magnesium, calcium, potassium, DTPA and sodium, extractable iron, zinc, copper and manganese content were more. In spite of that, vermicompost adds to the organic matter in the potting media and is a source of nutrition. Vermicompost, in suitable proportions, to potting media has synergistic effects on number of flowers (Nair and Bharathi, 2015).

Days taken to flowering (days)

The findings of the present investigation revealed that the minimum days taken to flowering was observed by the treatment T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the maximum days taken to flowering was recorded with T_1 [Soil]. It may be inferred from these observations that

only soil is not beneficial as a component of potting media for petunia in terms of days taken to flowering.

This might be due to influence of sand advances better drainage, aeration, lower compactness all along with vermicompost brings down the pH to optimum level for the accessibility of macro and micronutrients uptake by plant root system with the aid of improve water holding capacity and higher photosynthetic activity resulted in better C:N ratio. When C:N ratios gets improved, simultaneously florigen plant hormone level also improves, which is responsible for minimum days to flowering (Kala *et al.*, 2020).

Flower diameter (cm)

The findings of the present investigation revealed that the maximum flower diameter was observed by the treatment T_8 [Sand + Vermicompost (1:1)] which was significantly different from most of the treatment and the minimum flower diameter was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of flower diameter.

The increase in flower diameter is mainly due to the genetic make up and which might have been further modified by prevailing environmental condition and potting media. It helps in more accumulation of photosynthates in the sink (flower) from source (leaves). Continuous availability of photosynthates, cell division, cell elongation & cell enlargement remain on peak resulted in higher flower diameter (Kala *et al.*, 2020).

Flowering duration (days)

The findings of the present investigation revealed that the maximum flower duration was observed by the treatment T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the minimum flower duration was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of flowering duration.

Potting media T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] might have provided optimum growing environment particularly in the root zone besides supplying

sufficient nutrients in available forms as well as better physico-chemical and biological properties which led to better growth and flowering of plants. Thus exhibiting maximum flowering duration (Kala *et al*., 2020).

Fresh weight of above ground mass (g)

The findings of the present investigation revealed that the maximum fresh weight of above ground mass was observed by the treatment T_8 [Sand + Vermicompost (1:1)] which was significantly different from most of the treatment and the minimum fresh weight of above ground mass was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of fresh weight of above ground mass.

Fresh weight of above ground mass is related to the vegetative growth of plants such as plant height, the number leaves and the number of flowers. Good vegetative growth will increase the fresh weight of a plant. The planting medium must be porous and well drained to permit free roots penetration, secure anchorage, and have sufficient nutrients to support vegetative growth. The growing media can improve the physical properties of soils also can contribute nutrients for plant growth and development (Warnita *et al*., 2017)

Dry weight of above ground mass (g)

The findings of the present investigation revealed that the maximum dry weight of above ground mass was observed by the treatment T_8 [Sand + Vermicompost (1:1)] which was significantly different from most of the treatment and the minimum dry weight of above ground mass was recorded with T_1 [Soil]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of dry weight of above ground mass.

Media have better physical properties such as porous, high water holding capacity, also can increase the pH media. In addition media will contribute nutrients for plant growth that will improve plant dry weight. Olosunde *et al.* reported that an effective growth media should provide anchorage to the plant; hold sufficient available nutrients; be porous and well drained; relatively

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low in soluble salts; standardized and uniform; free pests and pathogens; biologically and chemically stable (Warnita *et al.*, 2017).

Fresh weight of root mass (g)

The findings of the present investigation revealed that the maximum fresh weight of root mass was observed by the treatment T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the minimum fresh weight of root mass was recorded with T_3 [Soil + Sand (1:1)]. It may be inferred from these observations that only soil is not beneficial as a component of potting media for petunia in terms of fresh weight of root mass.

Soil is a rich source of organic matter, nutrients and various microorganisms that hastens the root growth but has relatively lower porosity that is compensated by excellent porosity and water holding property of coco peat (Renuka and Sekhar, 2017).

Presence of vermicompost acts as synergistic factor along with cocopeat, which might be due to the reason that vermicompost being a rich source of macro and micronutrients enhanced the availability of these nutrients in an easily available form. Earthworm castings are known to be rich source of growth promoting substances viz., growth hormones, enzymes, antibiotics and vitamins. The enriched food and nutrient status of the rooting media and consequent development of conducting tissues could have facilitated greater uptake of water and thus leading to a higher fresh weight of roots in mycorrhizal inoculated media combinations especially in cocopeat + vermicompost based mixtures which could have complemented each other (Vijay *et al.*, 2018).

Dry weight of root mass (g)

The findings of the present investigation revealed that the maximum dry weight of root mass was observed by the treatment T_{14} [Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)] which was significantly different from most of the treatment and the minimum dry weight of root mass was recorded with T_3 [Soil + Sand (1:1)]. It may be inferred from these observations that

only soil is not beneficial as a component of potting media for petunia in terms of dry weight of root mass.

The high dry weight of roots might be due to a high value of corresponding fresh weight which might in turn due to a large number of sprouted roots that survived and grew longer. The cocopeat based media combinations recorded the maximum dry weight of roots which could be attributed to more number and length of roots. Vermicompost is a rich source of plant nutrients (N, P_2O_5, and K_2O), secondary elements (Mg and Ca) and vital micronutrients like B, Fe, Mo and Zn, which directly or indirectly improved dry weight of roots (Vijay *et al.*, 2018).

Table ~~no~~ 1: Effect of Different Growing Media on Growth and Flowering of Petunia

Parameters / Treatments	Plant length (cm) (30 days)	Plant length (cm) (45 days)	No. of leaves/ plant (30 days)	No. of leaves/ plant (45 days)	Stem diameter (cm) (30days)	Stem diameter (cm) (45 days)	No. of branches/ plant (30 days)	No. of branches/ plant (45 days)	No. of flowers/ plant	Days taken to flowering	Flower diameter (cm)	Flowering duration (cm)	Fresh weight of above ground mass (g)	Dry weight of above ground mass (g)	Fresh weight of root mass (g)	Dry weight of root mass (g)
T1	7.17	9.70	16.53	24.86	0.32	0.42	1.06	1.86	8.00	62.73	3.55	25.20	30.37	2.96	0.45	0.23
T2	14.38	18.81	55.46	77.46	0.47	0.73	4.13	7.66	9.60	62.33	3.87	32.26	80.57	7.93	0.46	0.24
T3	8.64	11.46	27.26	36.46	0.37	0.43	1.20	1.60	9.06	61.66	3.72	27.40	30.85	3.02	0.43	0.20
T4	10.64	11.90	34.46	37.20	0.41	0.50	2.33	3.46	9.73	60.66	4.02	28.33	33.54	3.42	0.49	0.26
T5	11.68	14.65	47.40	69.93	0.41	0.63	3.13	3.66	11.13	58.86	4.79	37.13	45.16	4.65	0.49	0.26
T6	7.84	11.13	21.33	37.40	0.40	0.47	1.13	3.46	10.33	61.66	4.48	34.66	42.76	4.17	0.64	0.39
T7	10.46	15.40	45.06	57.40	0.46	0.50	3.20	5.73	10.13	62.06	4.13	29.66	59.03	6.13	0.61	0.35
T8	12.60	17.09	41.66	56.53	0.44	0.61	3.93	7.13	10.93	60.00	4.87	36.40	81.45	8.31	0.59	0.34
T9	9.34	16.29	38.73	55.40	0.40	0.58	3.80	7.06	10.80	58.66	4.39	31.66	70.01	6.74	0.51	0.24
T10	10.22	18.26	36.06	49.73	0.43	0.70	3.13	4.40	11.20	58.13	4.18	36.13	58.37	5.56	0.58	0.36
T11	8.22	10.16	19.46	29.60	0.34	0.46	1.13	2.66	9.13	60.53	4.30	32.40	32.96	3.13	0.49	0.25
T12	10.07	18.40	36.20	41.00	0.41	0.47	3.60	6.20	12.00	57.73	4.68	36.66	60.09	5.60	0.51	0.28
T13	9.27	16.17	35.40	47.93	0.37	0.51	3.00	4.33	10.33	60.20	4.79	28.00	51.95	5.28	0.50	0.29
T14	12.56	15.90	34.33	42.13	0.40	0.50	5.00	8.20	12.46	56.20	4.40	42.13	72.99	7.19	0.66	0.41
SE(m)	**0.71**	**0.75**	**2.83**	**2.48**	**0.01**	**0.01**	**0.40**	**0.42**	**0.67**	**1.08**	**0.21**	**0.92**	**1.58**	**0.17**	**0.03**	**0.02**
C.D.	**2.07**	**2.18**	**8.24**	**7.23**	**0.03**	**0.05**	**1.18**	**1.24**	**1.97**	**3.17**	**0.61**	**2.67**	**4.61**	**0.51**	**0.11**	**0.05**

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