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Performance of marigold rooted cuttings on yield and quality transplanted from different growing media

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Abstract
A field investigation was carried out at Floriculture Unit, Department of Horticulture, Dr. PDKV, Akola during the years, 2016-17 and 2017-18 in Randomized Block Design to study the "Performance of marigold rooted cuttings on yield and quality transplanted from different growing media". The treatments comprised of twelve different propagating medias *viz*. soil, sand, vermicompost, FYM, cocopeat, soil + sand (1:1), soil+ vermicompost (1:1), soil + FYM (1:1), sand + vermicompost (1:1), sand + FYM (1:1), soil + sand + vermicompost (1:1:1) and soil + sand + FYM (1:1:1) with three replications. The results of the experiment revealed that, performance of transplanted marigold plants in respect of yield parameters *viz*. weight of flowers plant^{-1}, number of flowers plant^{-1},flower yield plant^{-1}, plot^{-1}and ha^{-1} were noticed maximum in the plants obtained from the vermicompost media. In respect of quality parameters, essential oil content and yield of xanthophyll obtained from different growing medias were found statistically non significant during both the years of the experimentation.

Keywords: Marigold, rooting media, vermicompost, cocopeat

Introduction
Marigold is native of Central and South America, especially Mexico. Marigold is one of the most commonly grown for garden decoration and extensively used as loose flower for making garlands for religious and social function. It has gained popularity amongst gardeners on account of its easy cultivation, wide adaptability and year round flower production. Marigold flowers have special importance during the festival days especially on Ganeshpuja, Durgapuja, Diwali and Dashehara. Marigold is an important commercial flower of India. Marigold can be grown in various types of climate and almost any part of the year in Maharashtra. There is a constant demand for flowers throughout the year for various functions, festivals, marriages and floral decoration. The climate of Maharashtra is most suitable to take this crop in all the three season with less efforts and expenditure. Also, no serious pest, diseases and disorder are found on this crop. Hence there is great scope to increase the area under this crop.

Marigold flower is a major source of carotenoids and lutein, is grown as a cut flower and in addition being grown for its medicinal values and a rich source of lutein, a carotenoid pigment. Now a days, lutein is becoming an increasingly popular active ingredient used in the food industry and textile coloration. This pigment has acquired greater significance because of its excellent colour value. Leaf paste is used externally against boils and carbuncles. Leaf extract is a good remedy for ear ache. Flowers extract is considered as blood purifier, a cure for bleeding piles and is also a good remedy for eye disease and ulcers.

The essential oil present in different species of Tagetes can find use in the perfume industry. Besides, marigold is growing today as commercially important source of carotenoid pigments. Marigold carotenoids are the major source of pigment for poultry industry as a feed additive to intensify the yellow colour of egg yolks and broiler.

In Maharashtra, growing floricultural crops commercially in media is picking up at a modest rate. Due to rapid urbanization and improvement in the aesthetic sense, there is an increased desire to buy quality produce from market. Soilless media offers good quality produce at reasonable cost. Till date no work has been done on standardization of media required for optimum rooting of marigold cuttings and it's production. The present study was therefore, undertaken to find out the suitable media for marigold production under Vidharbha conditions.

Materials and Methods
This experiment was conducted in Randomized Block Design with three replications at Floriculture Unit, Department of Horticulture, Dr. PDKV, Akola during the years 2016-17 and 2017-18.The allotment of treatments to the various plots were done randomly in each

replication. The treatments comprised of twelve different propagating medias *viz*. soil, sand, vermi compost, FYM, cocopeat, soil + sand (1:1), soil + vermi compost (1:1), soil + FYM (1:1), sand + vermi compost (1:1), sand + FYM (1:1), soil + sand + vermicompost (1::1:1) and soil + sand + FYM (1:1:1).

Propagation was done by using the terminal cuttings (8-10 cm).The cuttings were soaked in tap water for 15 - 20 minutes for better turgidity and earlier rooting. The cuttings were treated with 0.1 per cent carbendazim for 30 minutes and then planted in the pots filled with different media as per treatments. These pots were kept under shed. The foliage of cuttings were kept moist by spreading water (3-5 times every day to maintain 75-80 per cent relative humidity). A regular watering, weeding and plant protection measures were carried out as and when required. After one month, all the rooted cuttings of uniform size were selected and transplanted in main field and the relevant data were recorded particularly for weight of flowers plant^{-1} (g), number of flowers plant^{-1}, flower yield plant^{-1}(g), plot^{-1}(kg),ha^{-1}(t), essential oil content (%) and yield of xanthophyll (kg ha^{-1}). Recorded pooled data were analyzed as per statistical procedure of RBD for comparison of means.

Results and Discussion

Data presented in Table 1 and 2 exhibited significant effect on performance of marigold rooted (*Tagets patula* L.) cuttings on yield and quality parameters obtained from different growing media after transplanting in field during the years 2016-17 and 2017-18, respectively.

Table 1: Field performance of marigold plants in respect of weight of flower (g), number of flowers plant^{-1}, flower yield plant^{-1} (g) and flower yield plot^{-1} (kg) obtained from different growing media.

Treatments	Weight of flower (g)			Number of flowers plant^{-1}			Flower yield plant^{-1}(g)			Flower yield plot^{-1} (kg)		
	2016-17	2017-18	Pooled	2016-17	2016-17	2016-17	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T_1 –Soil	8.00	8.06	8.03	54.66	54.33	54.50	466.50	483.80	475.15	4.84	5.03	4.93
T_2 –Sand	9.03	9.13	9.08	63.66	63.66	63.66	575.53	581.80	578.66	5.79	5.56	5.67
T_3 –Vermicompost	12.03	11.53	11.78	69.00	70.66	69.83	830.23	814.76	822.50	7.27	7.06	7.16
T_4 –FYM	9.10	9.16	9.13	61.33	61.33	61.33	558.13	562.50	560.31	5.90	5.60	5.75
T_5 – Cocopeat	11.06	11.16	11.11	67.66	68.33	68.00	748.66	763.16	755.91	6.54	6.50	6.52
T_6 -Soil + Sand (1:1)	9.06	9.13	9.10	60.66	60.00	60.33	549.66	547.20	548.43	5.47	5.50	5.48
T_7 -Soil + Vermicompost (1:1)	10.03	10.13	10.08	60.33	61.00	60.66	605.30	618.20	611.75	5.70	5.93	5.81
T_8- Soil + FYM (1:1)	8.03	8.10	8.06	61.66	62.66	62.16	495.26	507.53	501.40	5.60	5.96	5.78
T_9-Sand + Vermicompost(1:1)	10.03	10.10	10.06	61.66	62.33	62.00	618.66	629.56	624.11	6.22	6.51	6.36
T_{10}-Sand +FYM (1:1)	10.06	10.13	10.10	58.33	60.00	59.16	550.00	549.73	549.86	6.05	6.36	6.21
T_{11}-Soil+sand+Vermicompost (1:1:1)	9.06	9.16	9.11	63.66	63.66	63.66	577.33	583.60	580.46	5.62	5.56	5.59
T_{12}-Soil+sand +FYM (1:1:1)	9.86	9.96	9.91	59.00	59.00	59.00	587.73	593.40	590.56	5.78	6.03	5.90
'F' Test	Sig.	Sig.	Sig.	Sig	Sig.	Sig.	Sig	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m) ±	0.37	0.37	0.37	2.54	2.81	2.64	36.41	38.02	36.97	0.17	0.25	0.20
CD at 5%	1.11	1.08	1.09	7.46	8.26	7.76	106.79	111.5	108.46	0.50	0.74	0.58

Table 2: Field performance of marigold plants in respect of flower yield ha^{-1} (t), essential oil content (%) and yield of xanthophyll (kg ha^{-1}) obtained from different growing media.

Treatments	Flower yield ha^{-1}(t)			Essential oil content (%)			Yield of xanthophyll (kg ha^{-1})		
	2016-17	2016-17	2016-17	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T_1 –Soil	23.03	23.03	23.03	0.023	0.021	0.022	408.88	410.22	409.55
T_2 –Sand	28.42	28.42	28.42	0.055	0.056	0.056	511.58	514.91	513.25
T_3 –Vermicompost	40.99	40.99	40.99	0.133	0.134	0.133	737.98	739.44	738.71
T_4 –FYM	27.56	27.56	27.56	0.076	0.077	0.076	496.11	499.23	497.67
T_5 – Cocopeat	36.97	36.97	36.97	0.118	0.120	0.119	665.48	673.11	669.29
T_6 -Soil + Sand (1:1)	27.14	27.14	27.14	0.042	0.042	0.042	521.66	530.00	525.83
T_7 -Soil + Vermicompost (1:1)	29.89	29.89	29.89	0.051	0.044	0.048	533.70	537.03	535.37
T_8- Soil + FYM (1:1)	24.45	24.45	24.45	0.035	0.037	0.036	440.23	442.70	441.47
T_9-Sand + Vermicompost(1:1)	30.55	30.55	30.55	0.070	0.074	0.072	503.33	511.33	507.33
T_{10}-Sand +FYM (1:1)	27.16	27.16	27.16	0.052	0.089	0.071	416.66	423.33	420.00
T_{11}-Soil+sand+Vermicompost (1:1:1)	28.51	28.51	28.51	0.106	0.107	0.106	468.00	474.66	471.33
T_{12}-Soil+sand +FYM (1:1:1)	29.02	29.02	29.02	0.043	0.049	0.046	464.80	468.13	466.46
'F' Test	Sig	Sig	Sig	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
SE (m) ±	1.79	1.79	1.79	0.024	0.029	0.026	71.97	70.32	71.10
CD at 5%	5.27	5.27	5.27	-	-	-	-	-	-

Performance of transplanted marigold plants during both the years (2016-17 and 2017-18) of experimentation in respect of weight of flowers plant^{-1} (12.03 and 11.53 g), number of flowers plant^{-1} (69.00 and 70.66),flower yield plant^{-1} (830.23 and 814.76 g),flower yield plot^{-1} (24.90 and 24.44 kg) and flower yield ha^{-1} (40.99 and 40.23 t) were found significantly maximum in vermi compost media and this was found statistically at par with the cocopeat media *viz*. weight of flowers plant^{-1} (11.06 and 11.16 g), number of flowers plant^{-1} (67.66 and 68.33),flower yield plant^{-1} (748.66 and 763.16 g),flower yield plot^{-1} (22.46 and 22.89 kg) and flower yield ha^{-1} (36.97 and 37.68 t) during 2016-17 and 2017-18, respectively.

On the other hand, significantly minimum weight of flowers plant^{-1} (8.00 and 8.06 g), number of flowers plant^{-1} (54.66 and 54.33), flower yield plant^{-1} (466.50 and 483.80 g), flower yield plot^{-1} (13.99 and 14.51 kg) and flower yield ha^{-1} (23.03 and 23.89 t) were recorded in soil (control) media during both the years of the experimentation.

In quality parameters, performance of transplanted marigold plants in respect of essential oil content (%) and yield of xanthophylls (kg ha^{-1}) obtained from different growing media were found statistically non significant, during both the years of the experimentation. However, numerically maximum essential oil and xanthophyll (0.133, 0.134% and 737.98, 739.44 kg ha^{-1}) contents were recorded in vermi compost treatment and minimum (0.023, 0.021% and 408.88, 410.22 kg ha^{-1}) were noticed in soil i.e control treatment.

On the basis of above findings, it can be concluded that, either vermicompost or cocopeat alone exhibited better rooting media for performance of marigold (*Tagets patula* L.) cuttings after transplanting in field.

Vermicompost tend to increase in flower size than in the control, so that this increase was 8.53 mm in 60% vermicompost treatment more than control. The flower weight has also increased in vermicompost treatments and this increase was about 1.5 times more than control in all vermicompost treatments were found by Shadanpour *et al*. (2011) [8].

This might due to the fact that, vermicompost has little amount of solvable mineral than primitive material, also it has more humic acid and more capacity for cations exchange were reported by Atiyeh *et al.* (2001) [3]. Vermi compost has many nutrients such as phosphorus, potassium, calcium, magnesium as available for plants were found by Orozco *et al*. (1996) [7]

Flowering is a complex process in plant's life for which the plants requires optimum growth and nutrients and thus the media containing more nutrients produced higher number of flowers. Similar result was found by Kapoor *et.al.* (2000) [6] on the effect of different growing media for the propagation of bulb scales of lilium and reported that, number of bulblets $scale^{-1}$ were significantly higher with vermiculite than with other treatments.

These findings are in agreement with those of Dutt *et.al*. (2002) [5] and they investigated that, cocopeat + compost showed maximum number of flowers in chrysanthemum and Baheer (1997) [2] investigated that, coco peat gave maximum number of flowers in gebera. This might be due to vigorous vegetative growth and increasing the carbohydrate reserve material with the proper uptake of all available nutrients also increase the number of suckers of plant, number of flower stalk which resulted to the more number of cut flowers. This could be due to the better physical properties of the substrate media which influences the absorption of nutrients by the plants. As the vegetative growth was better, it would have influenced positively on flower production. While, lowest response was noted in normal soil.

There is much evidence that, the activity of earthworms accelerates organic matter mineralization, decomposition of polysaccharides, increase the humus material, reducing the carbon to nitrogen ratio and reducing availability of heavy elements (Domingues *et al*., 1997). [4] Vermi compost indirectly had impact on soil micro flora will affect the plant growth. For example, adding vermicompost to the growth medium containing peat increases the colony formation of mycorrhiza (Cavender *et al.,* 2003) [3].

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