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Studies on the effect of different soil types in combination with organic and inorganic media on chrysanthemum (*Dendranthema grandiflora* Tzvelev)

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Abstract
The current research was laid out in Completely Randomized Design (CRD) in combination of 12 treatments containing 3 soil types (vertisol, alfisol, inceptisol) each in combination with 4 media types (cocopeat, fly ash, decomposed rice husk, undecomposed rice husk) and 3 control treatments (sole soils), altogether 15 treatments replicated thrice for analyzing the efficient potting media for quality production of potted chrysanthemum. The best desirable values for parameters including days taken to first bud appearance, total flowers plant-1, flower diameter, flower weight and flower yield was observed in T_2 (vertisol+cocopeat). The present study revealed that as far as potting media is concerned, T_2 (vertisol+cocopeat) is found to be superior and may be recommended for pot culture of chrysanthemum.

Keywords: Dendranthema grandiflora Tzvelev, pot culture, grow bags, growing media, cocopeat, vertisol

1. Introduction
Chrysanthemum is a well-known commercial flower crop of several countries worldwide. It is one of the most lucrative winter season flowers grown in India for its bewitching colours, shapes, shades and keeping quality. Due to its origin and commercial production in Asia, it is also called as “Glory of the East” or “Queen of the East”.

In India, chrysanthemums occupy an area of about 2.1 lakh hectares with a production of 185.24 thousand tonnes as loose flower and 14.93 thousand tonnes as cut flowers (Anonymous, 2017) [1]. The increment in the demand of flowering pot plants seems to be a result of the trend, shifting away from cut flower production. There is a considerable commercial importance of potted chrysanthemums for purpose including instant gardening, indoor and outdoor decoration. These potted plants can easily be handled and carried to places which need to be landscaped immediately. With the growing population and lack of open spaces, one has to depend largely on potted plants for decorating their surroundings. In the pot plants both artificial and natural potting media are being used. Potted flowering plants need suitable rooting atmosphere for proper growth whereas field or traditional soils are generally unsatisfactory for the production of plants in containers in terms of poor aeration, drainage and water holding capacity. The frequent water demanded by container plants cause various soils to compact into a tight, brick-like mass (Tariq *et al.* 2012) [8] and nutrient management is also more difficult as indigenous soils have their own nutritional status, which interferes with the plant nutrient uptake ability for the growth and development (Younis *et al.* 2013) [11]. In context of plants grown in pots, the growing media is one of the main factors that enable good, healthy and profitable plants. Soil supplemented with various light-weight growing media like cocopeat, vermicompost, rice husk, etc. alters the physico-chemical characteristics of the growing mixture and effect plant development.

With an increasing demand of container grown plant materials to use within the country and for shipment to the foreign countries, also increases the need of a light weighted growing medium prepared with locally available materials. Therefore, it is important to compare and analyse the efficiency of organic and inorganic media combinations with that of appropriate soil to find out the best combination of growing media in order to provide best possible growth by making the right initial choice.

2. Materials and Methods

The experiment was undertaken in Grow bags (UV stabilized) under open conditions at the Horticultural Research cum Instructional Farm, Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during the year 2019-20. The place of investigation was located in Raipur which lies in the central region of Chhattisgarh at21.25°N latitude and 81.63°E longitude with an elevation of 291m above the mean sea level (MSL).

Mixture of soil, vermicompost and media was filled in the grow bags (16×16×30 cm)-UV stabilized (600 gauges) having pre-punched bottom holes for thorough drainage in the ratio 2:1:1 (Table 1) and to this the rooted cuttings of chrysanthemum were planted, keeping 5 grow bags in each replication. Regular inter-cultural operations were carried out as and when required. Soil sample analysis was done at the trial initiation. Observations regarding floral parameters were noted. The results obtained were statistically evaluated using Completely Randomized Design (CRD).

3. Results and Discussion

In the present study, the collected observational data was statistically analysed using the method of analysis of variance as described by Panse and Sukhatme (1985) [7].

With respect to days taken to first bud appearance of flower, treatments revealed no significant variation (Table 2). Minimum days taken for first bud appearance (22.7 days) was recorded on application of treatment T_2 (vertisol+cocopeat). The result appeared in accordance to those obtained in Asiatic lilies where flower bud appearance with media compositions amended with cocopeat was earliest (Dalai *et al.* 2015) [3]. The greatest value for flowers plant-1 (9.7) was noted on application of treatment T_2 (vertisol+cocopeat) while the least value for flowers plant-1 (6.0) was observed with application of treatment T_8 (alfisol+fly ash) because of compactness of this media and inability to provide good aeration for root growth. Awang *et al.* (1997) [2] revealed that marigold plants grown on 100% peat produced 36% less flowers than plants grown on 100% cocopeat.

The greatest value for flower diameter (6.91 cm) was recorded at treatment T_2 (vertisol+cocopeat). These findings are also supported by the findings of Wuryaningsih *et al.* (2003) [10], Kameshwari *et al*. (2014) [5] and Janakiram *et al.* (2006) [4] in chrysanthemum, where cocopeat media indicated the highest effect on flower diameter.

The flower weight was found to be significant among the treatments. Treatment T_2 (vertisol+cocopeat) recorded maximum value (3.0 g). Plants grown on cocopeat accumulated more fresh weight in flower buds and leaves in oriental lily (Treder, 2008) [9].

The greatest value for flower yield plant-1 (29.1 g) was observed in treatment T_2 (vertisol+cocopeat). Nair and Bharati (2015) [6] relegated the fact that higher yield plant-1 was obtained on the particular treatment due to higher plant height, more number of flowers plant-1, more number of primary and secondary branches thereby more yield plant-1 in chrysanthemum.

4. Conclusion

Perusal of the data from the present findings concluded that the current media combination with that of soil had a superior performance in almost all considerable aspects under study.

Regarding all conventional soil based media under comparison, cocopeat proved to be superior over others giving best results besides being durable, light-weighted, having effective water absorbency as well as anti-fungal properties. Among the three soil media combinations (vertisol, alfisol and inceptisol), the combination of vertisol and cocopeat proved to be advantageous in almost all parameters. Hence, this study paved way for concluding that cocopeat based media can replace the traditional potting media and can be recommended for the same.

Table 1: Details of the experiment

Treatment	Details
T_1	Sole soil (vertisol/kanhar) – Control
T_2	Vertisol+cocopeat
T_3	Vertisol+fly ash
T_4	Vertisol+rice husk (decomposed)
T_5	Vertisol+rice husk (undecomposed)
T_6	Sole soil (alfisol/dorsa) – Control
T_7	Alfisol+cocopeat
T_8	Alfisol+fly ash
T_9	Afisol+rice husk (decomposed)
T_{10}	Alfisol+rice husk (undecomposed)
T_{11}	Sole soil (inceptisol/matasi) – Control
T_{12}	Inceptisol+cocopeat
T_{13}	Inceptisol+fly ash
T_{14}	Inceptisol+rice husk (decomposed)
T_{15}	Inceptisol+rice husk (undecomposed)

Table 2: Effect of different potting media on floral characters of chrysanthemum

Notation	Treatment	Days to first bud appearance	No. of flowers plant-1	Flower diameter (cm)	Flower weight (g)	Flower yield per plant (g)
T_1	Vertisol	26.3	6.4	5.15	1.9	10.5
T_2	Vertisol+cocopeat	22.7	9.7	6.91	3.0	29.1
T_3	Vertisol+fly ash	26.3	8.2	5.07	2.0	12.1
T_4	Vertisol+rice husk (decomposed)	27.3	7.5	5.82	2.1	11.7
T_5	Vertisol+rice husk (undecomposed)	25.3	8.9	6.89	2.6	20.9
T_6	Alfisol	24.3	7.8	5.56	1.6	13.3
T_7	Alfisol+cocopeat	26.0	8.7	6.32	2.3	21.4
T_8	Alfisol+fly ash	24.7	6.0	4.74	1.7	13.0
T_9	Afisol+rice husk (decomposed)	24.0	6.7	5.90	1.0	6.5
T_{10}	Alfisol+rice husk (undecomposed)	28.0	7.9	6.85	2.5	19.3
T_{11}	Inceptisol	24.0	8.1	5.98	1.5	12.3
T_{12}	Inceptisol+cocopeat	25.0	8.3	4.93	1.2	8.8
T_{13}	Inceptisol+fly ash	29.3	7.1	6.65	1.6	11.2
T_{14}	Inceptisol+rice husk (decomposed)	27.7	6.4	4.84	1.0	5.3
T_{15}	Inceptisol+rice husk (undecomposed)	23.7	6.2	5.99	1.0	5.6
$S.E_{m\pm}$		1.39	0.60	0.48	0.19	0.93
C.D. at 5%		NS	1.75	1.39	0.56	2.70

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