

## Effect of different potting mixtures on growth and flowering characters of *Chrysanthemum* cv. Haldighati

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### ABSTRACT

This study evaluates the effect of different potting mixtures on growth and flowering of *Chrysanthemum* cv. Haldighati. The experiment was carried out at Agriculture Farm, School of Agricultural Sciences & Technology, RIMT University, Mandi Gobindgarh, Punjab, India. Different treatment methods include mixing sand, soil, cocopeat, ver powder, farmland fertilizer and perlite in equal proportions. Statistical analysis of the data show that the medium combination has a significant influence on the control value. The results show that the overall performance of *Chrysanthemum* is better in the medium with T<sub>7</sub> (Perlite + FYM + garden soil (2:1:1)), but T<sub>5</sub> is Vermicompost + FYM + Garden soil (2:1:1) has the highest main branches of each plant and the number of sub-branches per plant, the number of ray florets per flower, the length of ray florets and the width of ray florets. According to the obtained results, it can be concluded that compared with perlite *Chrysanthemum*, the potting medium treatment combination consisting of Perlite + FYM + garden soil (2:1:1) is most suitable for producing *Chrysanthemums*. It has been found that the light growth medium is more suitable for plant morphological development and continuous high-quality flower production.

Figure : 00

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KEY WORDS : FYM, Perlite.Potting mixture, Production, Vermicompost.

### Introduction

*Chrysanthemum* (*Dendranthema grandiflora*) is a valuable commercial flower crop, belonging to Asteraceae family, its chromosome number is  $2n = 18$ , and it is grown worldwide with its attractive flowers. *Chrysanthemum* is a perennial herb, widely planted worldwide, its beautiful and charming flowers have an excellent vase life. *Chrysanthemum* is one of the important ornamental plants. Both cut flowers and potted plants have high economic value<sup>34</sup>. Potted *Chrysanthemums* or potted moms are popular choices for beautifying living spaces, balconies and terraces. *Chrysanthemums* can also be used in potted mums, bedding, border plants and hanging baskets<sup>19</sup>. Demand of *Chrysanthemum* flowers in India exists in big metropolitan cities like Delhi, Kolkata, Mumbai, Bangalore, Coimbatore<sup>16</sup> etc. Pot mums occupy an important place in the European, North American and Japanese floriculture trade. The major producing countries are Germany, Italy, Poland, Hungary and Russia. The Netherland and Columbia are the leading exporters of *Chrysanthemum*<sup>19</sup>.

The limited flowering period of *Chrysanthemums* is the main bottleneck for the commercialization of this crop<sup>30</sup>. The current trend in the *Chrysanthemum* industry is focused on improving the quality of flowers and creating an environmentally friendly production system. In order

to achieve these goals and accelerate the production of *Chrysanthemums*, further innovations are needed in improving the fertilization system and other production technologies<sup>12</sup>. Potting media is one of the most important factors required for the production of good quality pot mum<sup>7</sup>. Growth medium is known to have effect of value of potted ornamental plants and plays an important role in germination rate and many other physiological parameters including plant height, number of leaves, spike length, number of florets per spike, spike diameter and yield etc<sup>10</sup>. The selection of a good medium should serve as reservoir for plant nutrients, provide support for plant growth, hold water for availability to the plant and facilitate exchange of gases between roots and atmosphere above the root medium. A best growing media should have proper aeration, water holding capacity and adequate nutrition supply when applied in combination with soilless substrates<sup>14</sup>.

The culture medium can be used as a soil conditioner, not only improves soil organic matter, increases soil porosity, but also provides usable plant, and also provides necessary nutrients to promote normal growth and development. The physical properties of the growth medium mainly affect the aeration and water retention status, which is essential for maintaining the balance between water and gas exchange in a limited

TABLE -1 : Effect of different potting mixtures on growth of *Chrysanthemum cv. Haldighati*.

Treatments	Plant height (cm)	Number of leaves /plant	Number of main branches /plant	Number of sub branches/plant	Leaf length (cm)	Leaf width (cm)
T <sub>1</sub>	14.94	19.77	6.33	7.88	3.65	1.73
T <sub>2</sub>	15.16	16.53	7.18	9.48	4.05	2.20
T <sub>3</sub>	17.18	23.55	9.96	11.18	5.72	3.46
T <sub>4</sub>	15.20	22.00	9.16	10.43	4.67	2.46
T <sub>5</sub>	15.22	29.55	10.89	12.56	5.82	3.56
T <sub>6</sub>	17.20	24.31	7.33	10.81	5.25	3.31
T <sub>7</sub>	18.50	31.66	9.87	11.77	6.19	3.64
SEm ±	0.41	0.54	0.25	0.33	0.17	0.16
C.D. at 1%	1.74	2.29	1.09	1.42	0.72	0.67

pot<sup>15</sup>. Among the physical properties, total porosity and water holding capacity are probably the most important factors, while the chemical properties of the medium mixture (such as pH, EC, and nutritional status) play a crucial role in plant development<sup>5,33</sup>. Cocopeat is an organic by-product from coir industry obtained after the extraction of fiber from the coconut husk. The cocopeat is light in weight with low shrinkage, low bulk density and has slow biodegradation with longer decomposition time (10 years). The cocopeat can be effectively recycled and has acceptable<sup>8,25</sup> pH (5.2-6.8). Cocopeat contains soluble salts of chloride and sodium as well as higher contents of K. Vermicompost is also known as worm castings, worm humus or worm manure and end product of the breakdown of organic matter by the earthworm. This compost is a tasteless, clean organic material that contains sufficient amounts of N, P, K and several micronutrients necessary for plant growth. Perlite is a siliceous mineral derived from volcanic rocks. The lightness and uniformity of perlite is very useful for increasing aeration and drainage. Cattle manure is a waste fertilizer from cattle farms, which plays a role in improving soil physical properties and enriching soil nutrients<sup>31</sup>.

## Materials and Methods

### Plant Material and Treatments

The experiment was conducted at Agriculture Farm, School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab during 2019, which is situated at 30° 56' 11.90"N latitude and 76° 18' 13.18"E at an elevation of 268 meters above mean sea level. Our experiments were carried out as a pot experiment. A pot experiment was conducted to determine the effect of different potting mixtures on the growth and flowering of *Chrysanthemum cv. Haldighati*. The experiment was planned with seven treatments viz.

Garden Soil : Control ( $T_1$ ), Cocopeat + Garden soil (1:1) ( $T_2$ ), Cocopeat + FYM + Garden Soil (2:1:1) ( $T_3$ ), Vermicompost + Garden Soil (1:1) ( $T_4$ ), Vermicompost + FYM + Garden soil (2:1:1) ( $T_5$ ), Perlite + Garden soil (1:1) ( $T_6$ ), Cocopeat Perlite + FYM + Garden soil (2:1:1) ( $T_7$ ) in a Completely Randomized Design (CRD) with three replications. Three equally spaced plants were kept in one pot in one replication. The climate of Mandi Gobindgarh is typically semi-arid and sub-tropical with hot and dry summer (April to June), hot and humid monsoon period (July to September), mild winter (October to November) and cold winter (December to February). Weather parameters play an important role in the growth and developmental process of the crop hence it is important to present climatic variables. The mean daily maximum and minimum temperature during the growing season of *Chrysanthemum* fluctuated between 33 °C and 23 °C, respectively and relative humidity ranged from 61 to 74 per cent. There was a total rainfall of 92.6 mm during experimentation.

#### Potting Mixture Preparation

The potting mixture was prepared by using different media (such as coconut oil, powder, perlite, garden soil and farmland fertilizer). According to the processing conditions, all experimental pots have been filled with different types of media. Prepared the pot with garden soil, cow dung, vermi compost and coconut shell powder, used them together and mixed appropriately. The size of the pot used in this experiment was 12 inches. The total number of pots in the experiment was 21. Before filling the potting medium, thoroughly washed and cleaned the pot. According to the treatment method, 21 pots were filled with the required potting medium. Then filled the pot with a homogeneously mixed potting medium. Mixed the potting media used for other treatments in the same way and completed the potting. The 5-7 cm long cuttings were taken from healthy stocks of CSIR-NBRI in Lucknow. Plant healthy cuttings in flower pots and gently sprayed water with the help of rose pots.

#### Cultural practices

For the normal growth of plants, frequent irrigation is required. Observed the plants every day and watered them manually with a hand sprinkler when needed. Watered the pots in similar amounts every 4-5 days. The *Chrysanthemum* was pinched within one month after planting to destroy its apical dominance, thereby increasing its lateral spread. Weeding was carried out when needed to protect crops from weeds and loosen the growing medium.

#### Growth and Flowering Parameters

*Chrysanthemum* cuttings planted in pots were

observed regularly and data on plant height, number of leaves per plant, number of main branches, number of sub branches, leaf length, leaf width, days to bud initiation, number of flowers per plant, fresh weight of flower, dry weight of flower, longevity of flowers, duration of flowering were collected at regular interval. The growth and flowering observations were recorded in three plants randomly selected in each treatment.

#### Statistical Analysis

The data on various vegetative characters and floral characters were recorded and statistically analysed. The qualitative parameters characters were analyzed by the analysis of variance (ANOVA) technique. The data were subjected to statistical analysis adopting the standard procedure<sup>24</sup>. The critical difference values were calculated at 1 percent level of significance.

## Result and Discussion

#### Growth Parameters

There were significant differences with respect to growth parameters like plant height (cm), number of leaves/plant, number of main branches/plant, number of sub-branches/plant, leaf length (cm) and leaf width (cm) in all the treatment combinations. Data about growth are presented (Table-1). Application of  $T_7$  (Perlite + FYM + Garden soil (2:1:1)) resulted in maximum plant height (18.50 cm) followed by  $T_6$  (17.20 cm),  $T_3$  (17.18 cm) and  $T_5$  (15.22 cm), While the minimum plant height (14.94 cm) was reported under  $T_1$  (control). These results corroborate the earlier findings in rose<sup>36</sup> in *Chrysanthemum*<sup>1</sup> and in carnation<sup>35</sup>, who had recorded maximum plant height in media containing cocopeat + leaf mould because of high nutritional level in cocopeat and leaf mould. Application of  $T_7$  (Perlite + FYM + Garden soil (2:1:1)) resulted in maximum number of leaves per plant (31.66) followed by  $T_5$  (29.55),  $T_6$  (24.31) and  $T_3$  (23.55), While less number of leaves per plant (16.53) was recorded under  $T_2$  (cocopeat and garden soil (1:1)). This result also supported the findings<sup>13,26</sup> in lily. They observed that composted rice hull + sawdust + pine bark (1:1:1) was more appropriate medium for production of the highest number of leaves due to high water holding capacity, good aeration and cation exchange capacity of the media. Maximum number of main branches per plant was recorded with treatment  $T_5$  (Vermicompost + FYM + Garden soil (2:1:1)) followed by  $T_3$  (9.96),  $T_7$  (9.87) and  $T_4$  (9.16), While the lowest number of main branches per plant (6.33) was noticed under  $T_1$  (control). This is in accordance with the previous findings in carnation<sup>35</sup> and in dahlia<sup>32</sup>, who had reported highest number of main branches per plant in media containing Coco peat combined with Silt + Leaf manure. Application of  $T_5$  i.e.

TABLE-2 : Effect of different potting mixtures on flowering of *Chrysanthemum cv. Haldighati*.

Treatments	Days to bud initiation	Number of flowers /plant	Fresh weight of flower (g)	Dry weight of flower (g)	Duration of flowering (Days)	Longevity of flowers (Days)
T <sub>1</sub>	52.22	18.33	0.55	0.18	22.43	27.44
T <sub>2</sub>	47.33	19.33	0.46	0.12	23.55	31.44
T <sub>3</sub>	41.88	21.39	0.81	0.24	28.44	36.33
T <sub>4</sub>	46.00	20.04	0.72	0.20	24.22	32.77
T <sub>5</sub>	39.55	21.42	0.90	0.31	28.54	40.44
T <sub>6</sub>	44.00	20.22	0.74	0.21	25.79	35.55
T <sub>7</sub>	38.77	22.00	0.93	0.35	29.68	45.44
SEm ±	0.34	0.26	0.04	0.01	0.30	0.43
C.D. at 1%	1.44	1.10	0.18	0.06	1.26	1.81

Vermicompost + FYM + Garden soil (2:1:1) recorded with the more number of sub branches per plant (12.56) followed by T<sub>7</sub> (11.77), T<sub>3</sub> (11.18) and T<sub>6</sub> (10.81), While, the lesser number of sub branches per plant (7.88) was noticed under T<sub>1</sub> (control). Present findings get support from the earlier work in *Phlox drummondii* plant<sup>20</sup>, in zinnia<sup>27</sup>, who also reported that the highest number of sub branches was obtained, when growing media containing sand + silt + leaf mould was used. The maximum leaf length (6.19 cm) was found when plant treated with the T<sub>7</sub> i.e. Perlite + FYM + Garden soil (2:1:1) followed by T<sub>5</sub> (5.82 cm), T<sub>3</sub> (5.72 cm) and T<sub>6</sub> (5.25 cm). While, T<sub>1</sub> (control) resulted the minimum leaf length (3.65 cm). It was in conformity in marigold<sup>21</sup> and in osteospermum<sup>23</sup> that who had reported highest leaf length was obtained with media containing vermicompost + coarse sand + soil. Treatment T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) was recorded maximum leaf width (3.64 cm) followed by T<sub>5</sub> (3.56 cm), T<sub>3</sub> (3.46 cm) and T<sub>6</sub> (3.31 cm). However, the lesser leaf width (1.73 cm) was noticed under T<sub>1</sub> (control). This result agrees with the findings in tuberose<sup>16</sup> in osteospermum<sup>23</sup>, who had reported maximum leaf width with media sand + composted leaves. The positive effect of vermi compost and perlite on plant growth has been reported in China Aster<sup>22</sup> and Golden Rod<sup>17</sup>.

#### Flowering Parameters

There were significant differences with respect to flowering parameters like days to bud initiation, number of flowers/plant, fresh weight of flower (g), dry weight of flower (g), duration of flowering (days), longevity of flowers (days) in all the treatment combinations. Data about flowering are presented (Table-2). Applications of T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) were taken lesser number of days for bud initiation (38.77 days) followed by T<sub>5</sub> (39.55 days), T<sub>3</sub> (41.88 days) and

T<sub>6</sub> (44.00 days). While, the maximum duration for bud initiation (52.22 days) was reported under T<sub>1</sub> (control). The results are supported with the findings in anthurium, Barreto<sup>11</sup> and in Gerbera<sup>9</sup> which reported minimum days to bud initiation in media containing soil + cocopeat + leaf mould. This might be due to vigorous growth of the plant growing in the media and the rapid uptake of nutrients and water has a pronounced effect on early production. More number of flowers per plant (22.00) was counted with the T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) followed by T<sub>5</sub> (21.42), T<sub>3</sub> (21.39) and T<sub>6</sub> (20.22). While the lesser number of flowers per plant (18.33) was noticed under T<sub>1</sub> (control). These results are supported with the findings in marigold<sup>28</sup> and in anthurium<sup>11,30</sup> which obtained maximum number of flowers when rice husk, pine wood shaving, sludge and silt were used as growing media. The greater fresh weight of flower (0.93 g) was recorded when plants treated with T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) followed by T<sub>5</sub> (0.90 g), T<sub>3</sub> (0.81 g) and T<sub>6</sub> (0.74 g), While the less fresh weight of flower (0.46 g) was reported under T<sub>2</sub> (cocopeat and garden soil (1:1)). This result was supported with the earlier findings in rose<sup>36</sup> and in gerbera<sup>9</sup>, which also reported maximum fresh weight of flower was obtained when growing media soil + cocopeat + leaf mould was used. On the basis of obtained results various potting mixtures showed significant effect on dry weight of flower. Treatment T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) was

recorded with maximum dry weight of flower (0.35 g) followed by T<sub>5</sub> (0.31 g), T<sub>3</sub> (0.24 g) and T<sub>6</sub> (0.21 g). While, the minimum dry weight of flower (0.12 g) was recorded under T<sub>2</sub> (cocopeat and garden soil (1:1)). It was also conformity in gerbera<sup>9</sup> and in rose<sup>36</sup> which recorded maximum dry weight of flower with media containing soil + cocopeat + leaf mould. Application of T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) resulted in longest duration of flowering (29.68 days) followed by T<sub>5</sub> (28.54 days), T<sub>3</sub> (28.44 days) and T<sub>6</sub> (25.79 days). While, T<sub>1</sub> (control) resulted with shortest duration of flowering (22.43 days). These results are in corroboration with the findings in anthurium<sup>29</sup>, and in *Chrysanthemum*<sup>1</sup>, which reported maximum duration of flowering in media containing Cocopeat + Vermicompost + Bio compost. The maximum flower longevity (45.44 days) was recorded with the treatment T<sub>7</sub> (Perlite + FYM + Garden soil (2:1:1)) followed by T<sub>5</sub> (40.44 days), T<sub>3</sub> (36.33 days) and T<sub>6</sub> (35.55 days). Whereas, the minimum flower longevity (27.44 days) was found under T<sub>1</sub> (control). This is in accordance in gerbera<sup>4</sup> and in *Hydrangea macrophylla*<sup>6</sup>, which recorded maximum longevity of flowers with media containing soil + rice husk + cocopeat + castor cake + vermicompost. Therefore, it may be concluded that the use of vermicompost and perlite along with FYM helped in realizing better plant growth and better quality flowers of *Chrysanthemum*.

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