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EXPLORING THE INFLUENCE OF VARIOUS SUBSTRATE COMBINATIONS ON FLORAL CHARACTERISTICS OF WINTER ANNUALS

Arvind Malik[1], D. S. Dahiya[1], A. K. Godara[1], Vikas Kumar Sharma[2] and Raveena[1]
[1]Department of Horticulture, C.C.S. Haryana Agricultural University, Hisar, Haryana – 125004 India
[2]Department of Horticulture, Galgotias University, Greater Noida, U.P.- 201310 India
*Corresponding author E-mail: sainiraveena28@gmail.com

ABSTRACT

This study was carried out to explore the effect of substrates on flowering of different winter annuals (Larkspur, Antirrhinum, California poppy and Dahlia). The research was conducted at Centre for Quality Plant Material, CCS Haryana Agricultural University, Hisar, during 2015-16 to 2017-18. This research was arranged in a factorial randomized block design with seven substrate combinations and five replications. The results showed that the combination of cocopeat: vermiculite: perlite (3:1:1) gave maximum average spike length (28.2 cm) and number of spike per plant (18.9) in larkspur and antirrhinum. However, mean of largest flower diameter (6.0 cm) and number of flower per plant (71.6) was reported from California poppy and Dahlia. In case of different winter annuals the highest parameters of spike length and number of spike per plant (28.7 cm and 16.3 cm) was reported from antirrhinum, while highest maximum flower diameter (6.1 cm) was measured from dahalia.

***Keywords*:** Substrates, Flowering Parameters, Cocopeat, Perlite, Vermiculite

Introduction

Winter annuals germinate in autumn and grow vegetatively during winter. They are also able to tolerate comparatively low temperature and reproduce in spring or early summer. These are mainly raised for flowers and found to be highly delicate in the sense that they demands intensive care in terms of protection from water and other stresses. That is why these are usually raised on highly fertile soils and under assured water supply (Tomar and Minhas, 2002). In heavy soil without enough drainage, the growth and development winter annuals is suppressed and plants may susceptible to soil borne diseases and pests (Beattle and White, 1992). Growing medium not only acts as a growing place but also as a source of nutrient for plant growth and development (Wilson *et al.,* 2001). Generally, media for seedling are composed of soil, organic matter, pond soil, sand and other inert materials. Supplementing of the sand in substrate is aimed to make media more porous, while the organic matter is added to enrich adequate nutrients. Cultivation of winter annuals in soil is inexpensive, but it brings about some risks like- soil borne disease, insect and pest. Cocopeat is an agricultural by-product obtained after the extraction of fiber from the coconut husk (Abad *et al.,* 2002) and can be used as a growing medium to produce a number of crop species with acceptable quality (Yahya *et al.,* 1999; Yau and Murphy, 2000). Combination of cocopeat, perlite and vermiculite is considered as a good substrate medium with favorable pH, EC and other physical attributes (Abad *et al.,* 2002). The results of many experiments revealed that cocopeat used alone or as a component of soil or other soilless medium, suitable for roses (Blom, 1999), gerbera (Labeke-Van and Dambre-Van, 1998) and many potted plants (De-Kreij and Leeuven, 2001; Treder, 2003). Keeping in view of above points this study was conducted with the objective to standardized growing substrate for different winter annual production by incorporating various substrate components.

Materials and Methods

The study was carried out in a passively ventilated greenhouse at Centre for Quality Plant Material, CCS

Haryana Agricultural University, Hisar (Haryana) during winter season of 2015-16 to 2017-18. The seeds of larkspur, antirrhinum, California poppy and dahalia were placed in different combinations of cocopeat, vermiculite, perlite, vermicompost, FYM and sand after treating with fungicide. These substrates were used to create the seven different treatments in different proportion (by volume). The seven-substrate mixtures with five replications /treatments (with 5 plants/ replications) were arranged on a greenhouse trough. The treatments were:

S_1 – cocopeat + vermicompost + perlite (1:1:1)
S_2 – cocopeat + vermiculite + perlite (3:1:1)
S_3 – cocopeat + vermiculite + perlite (1:1:1)
S_4 – sand + vermicompost (9:1)
S_5 – sand + FYM (9:1)
S_6 – sand + vermiculite (9:1)
S_7 – sand (control)

The greenhouse with facility of controlling temperature, humidity and light with automation system for irrigation and fertigation was used. The transplanted plants were kept under uniform protected condition during the study period where all the management practices were carried out as per the package of practices. This study was prepared in factorial randomized block design (Factorial RBD) consists of two factors, namely A Factor (substrates) and B factor (winter annuals) as given by Panse and Sukhtme (1984). The overall significance of difference among the treatments was tested, using critical differences (C.D.) at 5% level of significance. The results were statistically analyzed with the help of a windows-based computer package OPSTAT (Sheoran *et al.,* 1998).

Results and Discussion

Spike length parameter of larkspur and antirrhinum as affected by different substrates was found significant, whereas, interactive values of substrate and winter annuals were non-significant (Table 1). The substrate combination of cocopeat + vermiculite + perlite (3:1:1) was found to be best followed by S_3 (24.9 cm) with regard to spike length, while flower crops grown in sand resulted in lowest spike length (19.8 cm) followed by S_6 (21.8 cm) and S_4 (23.0 cm). Antirrhinum gave more spike length (28.7 cm) as compare to larkspur (18.8 cm) in all substrate combinations. The results of this study indicate that as the amount of sand increases, the spike length of larkspur and antirrhinum is decrease significantly. This is might be due to cocopeat is considered as residue to improve aeration, water holding capacity and does not decompose easily. These results are in line with the findings of Samartzids *et al.* (2005), who reported higher yield components in rose when grown in various combinations of soilless substrates.

Table 1: Effect of substrates on spike length (cm) of different winter annuals under protected conditions

Treatment	Spike length (cm)		Mean
	Larkspur (T_1)	Antirrhinum (T_2)	
S_1-Cocopeat: Vermicompost: Perlite (1:1:1)	18.2	30.1	24.2
S_2- Cocopeat: Vermiculite: Perlite (3:1:1)	22.5	33.9	28.2
S_3- Cocopeat: Vermiculite: Perlite (1:1:1)	20.1	29.7	24.9
S_4- Sand: Vermicompost (9:1)	17.7	28.3	23.0
S_5- Sand: FYM (9:1)	19.8	28.7	24.5
S_6- Sand: Vermiculite (9:1)	16.8	26.8	21.8
S_7- Sand (Control)	16.3	23.4	19.8
Mean	**18.8**	**28.7**	
CD (p = 0.05)	**A = 1.50**	**B = 0.80**	**A×B = N.S.**

Data presented in Table 2 show that flower diameter of different winter annuals significantly affected by growing media combinations. The widest flower was observed in cocopeat + vermiculite + perlite (3:1:1) followed by S_1 (5.4 cm) and S_3 (5.4 cm), while smallest flower diameter (5.0 cm) was reported from both S_4 (Sand: Vermicompost, 9:1) and S_7 (Sand). In case of different winter annuals, it was observed that dahalia produced bigger flower (6.1 cm) than California poppy (4.5 cm). Combination of S_2 with dahalia could prove constructive approach towards flower diameter. The growing media which had combination of cocopeat + vermiculite + perlite showed maximum flower diameter (6.8 cm) in dahalia followed by S_1T_2 (6.3 cm), which was statistically at par with S_3T_2 (6.1 cm), S_5T_2 (6.1 cm) and S_7T_2 (6.1 cm). From this experiment, it was perceived that substrate media with combination of organic (cocopeat) and inorganic (perlite and vermiculite) increase flower diameter in California poppy and

dahalia. The better results for flower size in artificial media might be due to the improvement in root zone environment. Similar findings were observed by Sharma and Godara (2017) and Riaz *et al.* (2008), who reported that improvement in flower size with coconut coir, based growing media in strawberry and zinnia, respectively.

Table 2: Effect of substrates on flower diameter (cm) of different winter annuals under protected conditions

Treatment	Flower diameter (cm)		Mean
	California Poppy (T_1)	Dahalia (T_2)	
S_1-Cocopeat: Vermicompost: Perlite (1:1:1)	4.6	6.3	5.4
S_2- Cocopeat: Vermiculite: Perlite (3:1:1)	5.1	6.8	6.0
S_3- Cocopeat: Vermiculite: Perlite (1:1:1)	4.8	6.1	5.4
S_4- Sand: Vermicompost (9:1)	4.3	5.7	5.0
S_5- Sand: FYM (9:1)	4.4	6.0	5.2
S_6- Sand: Vermiculite (9:1)	4.6	5.6	5.1
S_7- Sand (Control)	3.9	6.0	5.0
Mean	**4.5**	**6.1**	
CD (p = 0.05)	**A = 0.30**	**B = 0.20**	**A×B = 0.40**

Results regarding to spike per plant in response to different growing substrate are given in Table 3 as mean. The significant higher spike per plant (18.9) were obtained in S_2 (cocopeat + vermiculite + perlite, (3:1:1) followed by S_3 (16.4) and S_1 (15.5), while lowest number of spike per plant (12.0) were obtained from S_7 (sand alone) followed by S_6 (14.0). Antirrhinum produced significantly more number of spikes per plant (16.3) as compare to larkspur (13.8). Combination of cocopeat + vermiculite + perlite in the ratio of 3:1:1, respectively gave highest number of spikes (19.5) in antirrhinum which was statistically at par with S_2T_1 (18.2), whereas, minimum number of spikes were obtained from S_7T_1 followed by S_5T_1 (11.6). This is might be due to the physiochemical properties of the growing media pose their effect on the flowering parameters of winter annuals. Significant results were also obtained by Abad *et al.* (2002) and Khan *et al.* (2006), who stated that cocopeat and perlite-based substrates increase nitrogen and phosphorus uptake by plants, which has direct effect on flowering in different ornamental pot plants.

Table 3: Effect of substrates on number of spikes per plant of different winter annuals under protected conditions

Treatment	Number of spikes per plant		Mean
	Larkspur (T_1)	Antirrhinum (T_2)	
S_1-Cocopeat: Vermicompost: Perlite (1:1:1)	14.4	16.6	15.5
S_2- Cocopeat: Vermiculite: Perlite (3:1:1)	18.2	19.5	18.9
S_3- Cocopeat: Vermiculite: Perlite (1:1:1)	14.5	16.2	16.4
S_4- Sand: Vermicompost (9:1)	13.2	15.0	14.1
S_5- Sand: FYM (9:1)	11.6	17.8	14.7
S_6- Sand: Vermiculite (9:1)	12.8	15.3	14.0
S_7- Sand (Control)	10.2	13.8	12.0
Mean	**13.8**	**16.3**	
CD (p = 0.05)	**A = 0.98**	**B = 0.82**	**A×B = 1.38**

The result of effect of different substrate combination on number of flowers per plant was found significant, however the difference between California poppy and dahalia were non-significant (Table 4). The results shows that highest number of flowers per plant (71.6) under protected conditions was observed in 3 cocopeat: 1 vermiculite : 1 perlite (S_2) followed by S_3 (62.8) and lowest number of flowers per plant (53.4) was recorded from S_6 (sand: vermiculite, 9:1), which was statistically at par with S_7 (53.8) and S_5 (55.0). The interaction of S_2 with California poppy resulted highest number of flowers per plant (73.8), which was statistically at par with S_2T_2 (69.4). This may be due to adequate supply of nutrients and moisture is necessary for the development of flowers and roots through coco based substrate combination, which create favorable

environment for the plants. These results are in the harmony with Sharma and Godara (2017) and Riaz *et al.* (2008), who reported that the difference in number of inflorescence was reported due to type of substrate in bags.

Table 4: Effect of substrates on number of flowers per plant of different winter annuals under protected condition

Treatment	Number of flowers per plant		Mean
	California Poppy (T_1)	Dahalia (T_2)	
S_1-Cocopeat: Vermicompost: Perlite (1:1:1)	54.8	63.2	59.0
S_2- Cocopeat: Vermiculite: Perlite (3:1:1)	73.8	69.4	71.6
S_3- Cocopeat: Vermiculite: Perlite (1:1:1)	63.1	62.4	62.8
S_4- Sand: Vermicompost (9:1)	67.2	56.2	61.7
S_5- Sand: FYM (9:1)	56.8	53.1	55.0
S_6- Sand: Vermiculite (9:1)	46.7	60.1	53.4
S_7- Sand (Control)	49.5	58.1	53.8
Mean	**58.8**	**60.4**	
CD (p = 0.05)	**A = 3.51**	**B = N.S.**	**A×B = 4.97**

Conclusion

The results of this research show a significant difference in floral characters of gerbera plants with the use different substrate combinations. According to the results, substrate combination S_2 (cocopeat + perlite + perlite, 3:1:1) improve the floral characters of both the varieties of gerbera.

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