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EFFECT OF GROWING MEDIA AND GIBBERELLIC ACID ON FLOWERING AND QUALITY OF CARNATION (*DIANTHUS CARYOPHYLLUS* L.) *CV.* WHITE LIBERTY

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Abstract

An experiment was carried out to study the "Effect of growing media and Gibberellic Acid on flowering and quality of Carnation (*Dianthus caryophyllus* L.) *cv.* White Liberty" at Kairacombai (village), Kotagiri (Taluk), The Nilgiris (district) during 2019 to 2020. The experiment was conducted by using different growing media combination *viz.,* M_1 - Garden soil : sand : Farm yard manure @1:1:1, M_2 - Garden soil : sand : vermicompost @1:1:1, M_3 - Garden soil : sand : coir pith @1:1:1, M_4 - Garden soil : sand : leaf mould @1:1:1 along with foliar application of Gibberellic Acid (GA_3) in three different concentration *viz.,* 100, 200 and 300 ppm at 40, 80, 120 and 160 days after planting in RBD. Results revealed that among the various flowering parameters assessed maximum days taken for first bud initiation, bud opening and flower bud development have been recorded maximum in the treatment T_6 (Garden soil: Sand: vermicompost @ 1:1:1) along with foliar application of Gibberellic Acid GA_3 @ 300 ppm. In the same way quality parameters such as bud length (cm), bud diameter (cm), flower length (cm), flower diameter (cm), flower stalk girth (mm), flower stalk length (cm) and vase life were performed best in the treatment T_6 with the application of Garden soil : Sand : Vermicompost @ 1:1:1 along with foliar application of GA_3 @ 300 ppm respectively than other treatments.

Key words: Carnation, Growing media, Gibberellic Acid.

Introduction

A large number of promising varieties of cut flowers are the auspicious creation of God to beautify the surroundings they symbolize beauty, peace, purity and they give us a unique way to share the love within people. Flower farmingplay a cardinal role in human behavior and bring tranquility and peace of mind to the people (Singh, 2006). A decade after liberalization in India floriculture industries took giant steps in the export arena which gave a dynamic shift from intensive subsistence production to commercial production of cut flowers. Among the cut flowers of the domestic and international markets, Carnation (*Dianthus caryophyllus* L.) originated from tracts of Mediterranean region substitutes all commercial flowers of a nosegay by its attractive shape and color, this made Carnation gain greater importance next to Rose. Various technologies have been formatted in order to boost up the productivity, nutrient management along with some horticultural techniques under protected environment conditions has brought a greater significance in maximizing the yield and quality of the flower crops. Application of organic amendments like farm yard manure, vermicompost, coir pith and leaf mould as a growing media improves the soil texture, soil porosity, and water retention capacity and maintains a congenial microbial population in which it increases the soil nutrition and at the same time it reduces the use of inorganic fertilizers. In this study, an attempt is made to find out the effect of growing media and Gibberellic Acid (GA_3) on growth, flowering, yield and quality of Carnation and to find out the best treatment combination for maximizing the flowering, quality and yield of Carnation.

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Materials and Methods

The present study entitled "Effect of growing media and Gibberellic Acid on growth, flowering, yield and quality of Carnation (*Dianthus caryophyllus* L.) *cv.* White Liberty" was carried out at Kairacombai (village), Kotagiri (Taluk), The Nilgiris (district) during 2019 to 2020. The experiment was laid out in randomized block design

with a plant spacing of about 15 cm × 15 cm containing 18 plants experimental per plot. The treatment details are ., T_1 - Garden soil : Sand : Farm yard manure@ 1:1:1 + 100 ppm of GA_3, T_2 - Garden soil : Sand : Farm yard manure @ 1:1:1 + 200 ppm of GA_3, T_3 - Garden soil : Sand : Farm yard manure @ 1:1:1 + 300 ppm of GA_3, T_4 - Garden soil : Sand : vermicompost @ 1:1:1 + 100 ppm of GA_3, T_5 - Garden soil : Sand : vermicompost @ 1:1:1 + 200 ppm of GA_3, T_6 - Garden soil : Sand : vermicompost @ 1:1:1 + 300 ppm of GA_3, T_7 - Garden soil : Sand : coirpith @ 1:1:1 + 100 ppm of GA_3, T_8 - Garden soil : Sand : coirpith @ 1:1:1 + 200 ppm of GA_3, T_9 - Garden soil : Sand : coirpith @ 1:1:1 + 300 ppm of GA_3 ,T_{10} - Garden soil : Sand : leaf mould @ 1:1:1 + 100 ppm of GA_3, T_{11} - Garden soil : Sand : leaf mould @ 1:1:1 + 200 ppm of GA_3, T_{12} - Garden soil : Sand : leaf mould @ 1:1:1 + 300 ppm of GA_3, T_{13} - Garden soil + Sand. table 1.

Table 1: Treatment details.

T_1	Garden soil : Sand : Farm yard manure @ 1:1:1 + GA_3 @100 ppm
T_2	Garden soil : Sand : Farm yard manure @ 1:1:1 + GA_3 @ 200 ppm
T_3	Garden soil : Sand : Farm yard manure @ 1:1:1 + GA_3 @300 ppm
T_4	Garden soil : Sand : vermicompost @ 1:1:1 + GA_3 @100 ppm
T_5	Garden soil : Sand : vermicompost @ 1:1:1 + GA_3 @ 200 ppm
T_6	Garden soil : Sand : vermicompost @ 1:1:1 + GA_3 @300 ppm
T_7	Garden soil : Sand : coirpith @ 1:1:1 + GA_3 @100 ppm
T_8	Garden soil : Sand : coirpith @ 1:1:1 + GA_3 @ 200 ppm
T_9	Garden soil : Sand : coirpith @ 1:1:1 + GA_3 @300 ppm
T_{10}	Garden soil : Sand : leaf mould @ 1:1:1 + GA_3 @100 ppm
T_{11}	Garden soil : Sand : leaf mould @ 1:1:1 + GA_3 @ 200 ppm
T_{12}	Garden soil : Sand : leaf mould @ 1:1:1 + GA_3 @300 ppm
T_{13}	Garden soil : Sand - Control

Three replications were maintained for each treatment. Thirty-day old seedlings were transplanted and planted in the raised beds of a polyhouseat a shallow depth with part of the root zone exposed. The optimum temperature inside the polyhouse was maintained at 20-23^{0}C during day time and 13-15^{0}C during night time. Relative humidity was maintained at 60- 80% during the growth of the plants till harvest. The recommended dose of fertilizers was given along with the drip irrigation as per the schedule. Intercultural practices were done for quality flowers. Netting was done in order to get flowers with long straight stalks. The plants were supported with the help of iron rods at both sides of the bed with 3 m distance. Pinching was done in four weeks after planting in order to break apical dominance and to ensure the maximum number of branches which lead to increased flower yield and quality. Disbudding was done by removing axillary buds. Foliar application of Gibberellic Acid (GA_3) was given according to the treatment schedule @ 100 ppm, 200 ppm and 300 ppm at 40, 80, 120 and 160 days after planting. The observations on vegetative characters such as plant height (cm), number of leaves, leaf length (cm), number of shoots, internodal length (cm) and number of internodes were recorded at 45, 90 and 120 Days After Planting and yield parameters such as flower yield plant^{-1}, flower yield per plot and flower yield per m^2. The data on various parameters were analyzed statistically as per the procedure suggested by Panse and Sukhatme (1978).

Results and Discussion

Flowering parameters

Flowering parameters such as days taken for first bud initiation, bud opening and flower bud development were observed and the parameters were statistically analyzed and presented below.

Days taken for flower bud initiation

The minimum days taken for flower bud initiation were observed in the best treatment T_6 (96.32 days after pinching) which had a combination ratio of growing media Garden soil : Sand : Vermicompost @ 1:1:1 along with foliar application of Gibberellic Acid (GA_3) @ 300 ppm at 40, 80, 120 and 160 days after planting. Whereas in the control the treatment (T_{13}) showed maximum days for flower bud initiation taken for 128.59 days after pinching table 2. The application of vermicompost enhances the nutrients available to the plants and the foliar application of Gibberellic Acid (GA_3) as plant growth regulator significantly influenced the days taken for first

Table 2: Effect of growing media and GA_3 on flowering parameters of Carnation (*Dianthus caryophyllus* L.) *cv.* White Liberty.

Treat-ments	Days for flower bud initiation	Days taken for flower bud opening	Days taken for flower bud development
T_1	121.28	132.57	21.41
T_2	113.97	122.54	19.16
T_3	105.01	113.75	17.09
T_4	118.83	129.18	20.65
T_5	110.81	119.75	18.51
T_6	96.32	110.36	16.37
T_7	123.71	135.99	22.16
T_8	111.52	119.09	18.42
T_9	105.97	112.94	17.02
T_{10}	126.17	139.31	22.95
T_{11}	116.40	125.86	19.91
T_{12}	108.38	116.34	17.75
T_{13}	128.59	154.37	25.73
S. ED	2.40	3.39	0.72
CD (p=0.05)	4.80	6.77	1.44

bud initiation. Hence Gibberellic Acid (GA_3) influenced the minimum days taken for flower bud initiation due to the increased rate of photosynthesis and CO_2 fixation. Further it would have favored convenience of factors in enhancing floral initiation *i.e.*, carbohydrate pathway and photo periodic pathway with GA_3 pathway. This was in trend with Ashwani Kasturi and Chandra Sekhar (2017) in Carnation and Fazilet *et al.,* (2019) in Gladiolus.

Days taken for flower bud opening

The minimum number of days for bud opening (110.36 days after pinching) was in the treatment T_6. It may be due to the fact that plants grown in the combination consisting of Garden soil : Sand : Vermicompost @ 1:1:1 along with foliar application of Gibberellic Acid (GA_3) @ 300 ppm at 40, 80, 120 and 160 days after planting has utilized the whole nutrient content of vermicompost and the influence of Gibberellic Acid (GA_3) has also increased the days for bud opening. The maximum days for bud opening were observed in treatment T_{13} (154.37 days) which was the control table 2. This was in similar to the findings of Suresh kumar *et al.,* (2019) in Tuberose and Rashid (2018) in Gladiolus.

Days taken for flower bud development

The early development of flower buds was found in the best treatment T_6 (16.37 days after pinching) which had vermicompost as the main combination with other growing substances and foliar application of Gibberellic Acid (GA_3) @ 300 ppm at 40, 80, 120 and 160 days after planting. Whereas the maximum number of days (25.73) for flower bud development was found in the control (T_{13}). This may be due to the use of nutrient-rich vermicompost and Gibberellic Acid (GA_3) which boosted the development of the flowers. This was in line with Harendra Tiwari *et al.,* (2018) in African Marigold and Fazilet *et al.,* (2019) in Gladiolus. table 2.

Quality parameters

Various quality parameters such as bud length (cm), bud diameter (cm), flower length (cm), flower diameter (cm), flower stalk girth (mm), flower stalk length (cm) and vase life were recorded and the data pertaining to these are presented below.

Bud length and diameter (cm)

The bud length (4.03 cm) and bud diameter (3.74cm) was found to be superior in T_6 due to the addition of vermicompost along with garden soil and sand along with the foliar application of Gibberellic Acid (GA_3) spray @ 300 ppm at 40, 80, 120 and 160 days after planting. The performance of the plant is achieved by the application of vermicompost plays a vital role in maximization of all vegetative characters initially in addition to that foliar application of growth regulator greatly influenced the bud growth which was similar to the findings of Syed Khudus *et al.,* (2017) in Calendula and Pritam Sangwan *et al.,* (2010) in Marigold. The least value of bud length (2.52 cm) and bud diameter (2.58 cm) was found in the control *i.e.* the treatment T_{13}. table 3.

Flower diameter and length (cm)

Table 3: Effect of growing media and GA_3 on flower quality parameters of Carnation (*Dianthus caryophyllus* L.) *cv.* White Liberty.

Treat-ments	Bud length (cm)	Bud diam-eter (cm)	Flower diam-eter (cm)	Flower length (cm)	Flower stalk girth (mm)	Flower stalk length (cm)	Vese life (days)
T_1	2.95	2.51	6.36	5.58	16.77	82.03	8.54
T_2	3.37	3.20	6.70	6.05	19.23	86.45	10.71
T_3	3.89	3.65	7.16	6.59	22.07	91.01	13.55
T_4	3.08	2.81	6.46	5.73	17.59	83.51	9.26
T_5	3.55	3.33	6.86	6.24	20.42	88.04	11.88
T_6	4.03	3.74	7.27	6.73	22.85	92.47	14.25
T_7	2.83	2.41	6.25	5.44	15.94	80.54	7.85
T_8	3.51	3.29	6.82	6.21	20.04	87.93	11.44
T_9	3.85	3.63	7.13	6.54	22.01	90.99	13.28
T_{10}	2.69	2.21	6.12	5.28	15.09	79.06	7.14
T_{11}	3.22	3.11	6.57	5.89	18.38	84.97	9.97
T_{12}	3.72	3.53	6.99	6.39	21.22	89.52	12.57
T_{13}	2.52	2.58	5.97	4.93	12.59	73.53	5.28
S. ED	0.12	0.09	0.10	0.14	0.79	1.46	0.69
CD (p=0.05)	0.23	0.18	0.20	0.28	1.58	2.91	1.38

Flower diameter (7.27cm) and Flower length (6.73 cm) were found to be higher in T_6 it may be due to the presence of vermicompost in the growing media. These vermicompost as one of the organic nutrients increases the supply of major nutrients in the soil which are required in large quantities for better quality flowers in an available form to plants. Whereas the least values of Flower diameter (5.97 cm) and Flower length (4.93 cm) were found in the control T_{13} table 3. Similar results were reported by Moghadam*et al.* (2012) in Lillium and Sable *et al.,* (2015) in Gladiolus.

Flower stalk girth (mm) and Flower stalk length (cm)

The treatment T_6 was found to be superior to others in the quality parameters such as Flower stalk girth (22.85 mm) and Flower stalk length (92.47 cm). Whereas T_{13} showed lower quality flowers as it was the control *viz*., Flower stalk girth (12.59 mm) and Flower stalk length (73.53

cm). This may be because the influence of nutrients in the growing media (Garden soil : Sand : Vermicompost @ 1:1:1) inasmuch it has provided a better rhizosphere atmosphere and beyond that vermicompost accelerates bio-oxidation of organic matter which encouraged the plants for better flower quality characters. This was in trend with the findings of Ghisewad *et al.,* (2016) in Gladiolus and Sindhu *et al.,* (2010) in Gerbera. table 3.

Vase life (days)

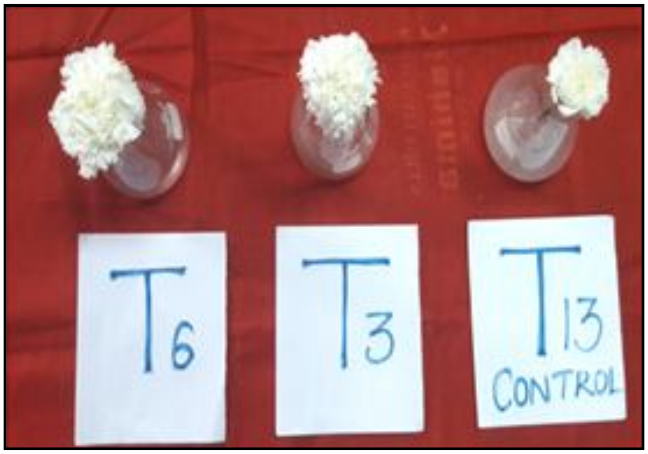
The flowers of T_6 (14.25 days) showed maximum vase life than compared to other treatments and minimum vase life was observed in T_{13} (5.28 days) which was the control. The variation in vase life might be due to application of effective growing media and foliar application of Gibberellic Acid (GA_3) at various combinations to the plants table 3. This variation in vase life among the flowers of different treatments might be attributed to the variations in accumulation of carbohydrates since these plants of different treatments could produce a greater number of leaves and indicated a positive an dsignificant correlation between all these quality parameters. These results are in conformation with the findings of Benny *et al.,* (2017) in Carnation, Mohamed (2017) in Carnation.

Conclusion

Based on the findings, it can be concluded that the treatment T_6 grown in the growing media consisting of Garden soil :Sand :Vermicompost @ 1:1:1 along with foliar spray of Gibberellic Acid (GA_3) @ 300 ppm at 40, 80, 120 and 160 days after planting, have served as the best

Bud diameter

Flower diameter



Stalk length

Vase life

T_6 - Garden soil : Sand :Vermicompost @ 1:1:1 + GA_3 @ 300 ppm (Best treatment)
T_3- Garden soil : Sand : Farm yard manure @ 1:1:1 + GA_3 @ 300 ppm (followed by T_6)
T_{13}- Control

treatment with respect to all the flowering and quality parameters. Hence it can be concluded from the study that growing media consisting of Garden soil : Sand : Vermicompost @ 1:1:1 along with Gibberellic Acid (GA_3) @ 300 ppm at 40, 80, 120 and 160 days after planting is best to obtain better growth and development of Carnations in polyhouse condition.

References

Ashwani Kasturi and R. Chandra Sekhar (2017). Effect of plant growth regulators on vegetative growth of Carnation (*Dianthus caryophyllus* L.) *cv.* Domingo in second season crop. *Plant Archives,* **17(2):** 113-116.

Benny, C.J., Devi Singh, U. Fatmi and Dona Ann Jose (2017). Effect of Plant Growth Regulators, Gibberellic Acid (GA_3) and Naphthalene Acetic Acid (NAA) on growth and yield of Carnation (*Dianthus caryophyllus* L.) under naturally ventilated polyhouse. *Plant Archives*, **17(2):** 803-812.

Fazilet Parlakova Karagoz, Atilla Dursun, Nasibe Tekiner, Raziye Kul and Recep Kotan (2019). Efficacy of vermicompost and/or plant growth promoting bacteria on the plant growth and development in Gladiolus. *Ornamental Horticulture*, **25(2):** 180-188.

Ghisewad, S.K., P.B. Sable and S.B. Rohidas (2016). Effect of organic and inorganic fertilizers on growth and flower quality of gladiolus *cv.* H.B. PITT. *Asian J. Hort*., **11(2):** 275-279.

Harendra Tiwari, Mukesh Kumar and R.K. Naresh (2018). Effect of nutrient management and gibberellic acid on growth, flowering and nutrients availability in post-harvested soil of Marigold (*Tageteserecta* L.) *cv.* Pusa Narangi Gainda. *International Journal of Chemical Studies*, **6(4):** 510-514.

Kaya, A.S., K. Aydinsakir and U.O. Karaguze (2019). Assessment of GA_3 and BA application on gerbera cultivation in soilless culture. *Int. J. Agric. Environ. Food Sci.,* **3(1):** 41-45.

Moghadam, A.R.L., Z.O. Ardebill and F. Saidi (2012). Vermicompost induced changes in growth and development of Lilium Asiatic hybrid *var.* Navona. *African Journal of Agricultural Research*, **7(17):** 2609–2621.

Mohamed E. Ibrahim (2017). Trials on the application of fertilization combined with plant hormone spraying for improving the production of carnation absolute oil. *Journal of Materials and Environmental Sciences,* **8(4):** 1284-1290.

Panse, V.G. and P. Sukhatme (1985). Statistical methods for agricultural workers. II*Edn., ICAR, New Delhi, India*.

Pritam Sangwan, V.K. Garg and C.P. Kaushik (2010). Growth and yield response of marigold to potting media containing vermicompost produced from different wastes. *Environmentalist,* **30:** 123–130.

Rashid, M.H. (2018). Effect of corm size and growth regulators on growth, ûowering and quality of gladiolus (*Gladiolus grandiûorus* L.). *Fundam. Appl. Agric.,* **3(3):** 596–601.

Sable, P.B., U.R. Ransingh and D.P. Waskar (2015). Effect of foliar application of plant growth regulators on growth and flower quality of gladiolus *cv.* H.B. Pitt. *J. Horticulture,* 02.10.4172/2376-0354.1000141.

Sendhilnathan, R., V. Madhubala, M. Rajkumar and R. Sureshkumar (2019). Effect of organic manures and micronutrients on growth and flowering attributes of Rose *cv.* Andhra red (*Rosa centifolia*). *Plant archives,* **19(2):** 3633-3637.

Sindhu, S.S. and D.B. Gholap (2010). Effect of medium amendments on growth and flowering in gerbera. *Indian Journal of Horticulture.,* **67:** 391-394.

Singh, A.K. (2006). Flower crops: cultivation and management. *New India Publishing*.

Sureshkumar, R., G. Sahana Priya, M. Rajkumar and R. Sendhilnathan (2019). Studies on the effect of organic manures, biostimulants and micronutrients on certain growth and flowering parameters of tuberose (*Polianthestuberosa* L.). *Plant achieves,* **19:** 2436-2440.

Syed Khudus, V.M. Prasad and S.M. Jogdand (2017). Effect of Plant Growth Regulators on Growth and Flower Yield of Calendula (*Calendula officinalis* L.) *cv.* Bon Bon. *Chem. Sci. Rev. Lett.*, **6(22):** 1290-1294.