Pre-harvest management in carnation to enhance flower yield

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ABSTRACT

An experiment was carried out to study the effect of pre-harvest management in carnation (*Dianthus caryophyllus* L) cv Malaga to improve the flower yield, quality and vase life by the foliar application of biostimulants. In the pre-harvest treatments, Panchagavya @ 2 per cent + Manchurian mushroom tea 4 per cent with RDF (NPK 19:19:19 @ 8 g, calcium nitrate 1.5 g, potassium nitrate 1.0 g, monopotassium phosphate 1.5 g, borax 0.5 g, magnesium sulphate 2.5 g) proved superior in respect of flower yield parameters viz lesser days taken to bud opening (157.8), maximum flower diameter (6.54 cm), highest stem length (84.90 cm), maximum number of petals per flower (73.83), maximum number of flowers per plant (11.53), maximum number of flowers per m^2 (415.20) and longest duration of flowering (80.87 days). This treatment also resulted in lowest disease incidence (2.42%).

Keywords: Carnation; foliar spray; biostimulants; flower yield parameters

INTRODUCTION

Carnation (*Dianthus caryophyllus* L) is one of the leading cut flower crops and ranks within the top ten cut flowers in the world florist trade. The domestic demand for cut carnation flowers has become high in recent years. Indian consumers depend on imported cut flower from other countries like Netherlands, Kenya and Malaysia. There are about 14 top exporting ports in India in which Bengaluru exports the majority of carnation shipments from India with the share of 21 per cent followed by Delhi with 16 per cent. The top 3 exporters of carnation flower are China with 1,466 shipments followed by Netherlands with 1,380 and Colombia at the 3rd spot with 1,375 shipments. As per Volza's India Export data, carnation flower export shipments from India stood at 606, exported by 94 Indian exporters to 142 buyers. India exports most of its carnation flower to New Zealand, United States and United Arab Emirates (https://www.volza.com/p/carnation-flower/export/export-from-india/).

The most important difficulties faced in carnation production are the climatic factors especially heat stress, which affects plant growth and production. The heat stress affects flower quality negatively in general and stem length of flower specially (Al-Ma'athidi et al 2013). One of the strategies in this paradigm shift is the augmentation of chemical fertilizers with partial supplementation of organic sources and certain nutrient generating components such as growth stimulants. This integrated approach aims at sustainable productivity with minimum deleterious effect of chemical fertilizers in view of both environment security and economic feasibility.

Panchagavya and Manchurian mushroom tea enhance the biological efficiency of the plants and improve the quality while complete substitution of inorganic fertilizers cannot be contemplated, yet there are adequate reports on the role of foliar application of nutrients in improving the growth and quality of carnation. Foliar application of nutrients is gaining more importance in fertilization of various field and flower crops of carnation (Verma et al 2003). The

application of foliar fertilizer is the quickest way to deliver nutrients to the tissues and organs of the crops. The present study was undertaken to investigate the pre-harvest response of cut carnation flowers to foliar application of biostimulants such as Panchagavya and Manchurian mushroom tea to improve flower yield. Renukardhya et al (2011), while working on INM in carnation cv Desio, revealed that 50 per cent RDF + vermicompost + 3 per cent Manchurian tea + 3 per cent Panchagavya helped in reducing the application of inorganic nutrients of about 50 per cent without any yield reduction. Harshavardhan et al (2016) reported that the flower quality and yield parameters of carnation viz flower bud diameter (1.67 cm), stalk length (75.45 cm), yield per plant (22.19) and yield per m^2 (634.27) were highest in treatment comprising 75 per cent recommended dose of NP and 100 per cent K + *Azospirillum brasilense* + *Bacillus megaterium* + VAM + vermicompost + Panchagavya + Jeevamrutha + *Trichoderma harzianum* as compared to 100 per cent recommended dose of fertilizers. Former treatment was best in improving flower quality and yield.

MATERIAL and METHODS

The experiment was carried out at Thummanatty, The Nilgris (Sigaram Self-Help Group). The experiment was laid out in a randomized block design with nine treatments replicated thrice in each plot size of 1.0 m x 1.0 m. Carnation cv Malaga, a standard type, was chosen for this study. Healthy rooted cuttings were obtained from Florance Flora Floriculture unit, Bengaluru, Karnataka. Before planting, the experimental plots were applied with 1 kg vermicompost, 200 g neem cake, 3 kg farmyard manure, 100 g CAN, 200 g superphosphate, 150 g muriate of potash, 50 g magnesium sulphate and 2 g borax per square meter; these were mixed in the beds and the rooted cuttings were planted at a spacing of 15 m x 15 cm. Single pinch method was employed and after pinching, fertigation was scheduled and applied one month after planting. Fertigation was done in Schedule A (Monday and Thursday) (1.5 g calcium nitrate, 1.0 g potassium nitrate, 8 g NPK 19:19:19 per square meter) and Schedule B (Tuesday and Friday) (1.5 g monopotassium phosphate, 0.5 g Borax, 2.5 g magnesium sulphate). Panchagavya and Manchurian mushroom tea were applied as foliar sprays in different doses at 15 days interval starting from one month after planting. The treatments used were T_1 (Panchagavya @ 2%), T_2 (Panchagavya @ 4%), T_3 (Manchurian mushroom tea @ 2%), T_4 (Manchurian mushroom tea @ 4%), T_5 (Panchagavya @ 2% + Manchurian mushroom tea @ 2%), T_6 (Panchagavya @ 2% + Manchurian mushroom tea @ 4%), T_7 (Panchagavya @ 4% + Manchurian mushroom tea @ 2%), T_8 (Panchagavya @ 4% + Manchurian mushroom tea @ 4%) and T_9 (Control). The observations were recorded on ten randomly selected plants every month after planting to harvest. The present investigations were undertaken to see the effect of biostimulants on flower yield of carnation to optimize the nutritional requirement under polyhouse condition.

RESULTS and DISCUSSION

The earliest bud opening was recorded in T_6 (Panchagavya @ 2 % + Manchurian mushroom tea @ 4%) (157.8 days) and T_2 (Panchagavya @ 4%) (159.4 days), which were at par. Earliness of flowering is a vital character apart from the other quality aspects deciding factor for early yield. The commencement of early flowering might be due to nitrogen application being a constituent of proteins, amino acids, nucleic acid, various enzymes and coenzymes. Hence, flowering was advanced with the increased supply of nitrogen. Moreover, another possible reason which could be attributed to early flowering might be the abundant availability of phosphorus in the soil that led to induction of early flowering (Beniwal et al 2005) in chrysanthemum. In Rose cv Edourd and red rose, a treatment combination of Panchagavya 5 per cent + calcium acetate 0.5 per cent proved to be effective in advance flowering as reported by Thamaraiselvi (2001).

Statistically maximum flower diameter (6.54 cm) was recorded in the treatment T_6. This could be due to foliar spray of higher concentration of Panchagavya along with inorganic fertilizers, that carried beneficial microbes produced during fermentation of Panchagavya which might have helped in the synthesis of growth promoting substances. Similar results were interpreted by Muthamizhselvi (2006) in chrysanthemum.

The number of petals per flower (73.83) and stalk length (84.90 cm) were highest in the treatment T_6. Even though more number of petals was present in the flowers, this treatment exhibited less calyx split showing the compactness of the bud that could have resulted in strong and long flower stalk and large sized buds. Similar observations were made by Kumar et al

Table 1. Mean performance of flowering and yield parameters in carnation cv Malaga

Treatment	Days taken to bud opening	Flower diameter (cm)	Number of petals/flower	Stem length (cm)	Number of flowers/plant	Number of flowers/m^2	Duration of flowering (days)	Disease incidence (%)
T_1	160.1	4.80	56.27	77.11	7.47	268.80	74.80	6.27
T_2	159.4	5.47	63.70	81.85	8.33	300.00	77.10	5.06
T_3	161.3	5.05	56.63	76.68	8.07	290.40	74.80	7.94
T_4	160.8	5.08	56.53	77.50	9.03	325.20	75.00	7.17
T_5	164.2	5.16	61.03	78.61	7.90	284.40	74.43	4.04
T_6	157.8	6.54	73.83	84.90	11.53	415.20	80.87	2.42
T_7	161.7	5.17	62.33	80.92	8.40	302.40	73.50	4.44
T_8	160.1	4.53	66.87	79.59	10.43	375.60	76.10	3.57
T_9	165.8	4.04	52.63	75.78	7.23	260.40	72.63	12.55
SEd	0.770	5.09	0.440	0.54	0.20	313.60	0.33	0.250
$CD_{0.05}$	1.610	0.060	0.940	1.15	0.42	5.766	0.70	0.530

Disease incidence – High: Disease index 50% and above, Medium: Disease index 10-50%, Low: Disease index less than 10%
T_1 (Panchagavya @ 2%), T_2 (Panchagavya @ 4%), T_3 (Manchurian mushroom tea @ 2%), T_4 (Manchurian mushroom tea @ 4%), T_5 (Panchagavya @ 2% + Manchurian mushroom tea @ 2%), T_6 (Panchagavya @ 2 % + Manchurian mushroom tea @ 4%), T_7 (Panchagavya @ 4% + Manchurian mushroom tea @ 2%), T_8 (Panchagavya @ 4% + Manchurian mushroom tea @ 4%) and T_9 (Control)

(1999) in carnation and Beniwal et al (2005) in chrysanthemum.

The number of flowers per plant (11.53) and per meter square (415.20) was also highest in T_6. Increased number of flowers per plant could have been influenced by the application of organic manures combined with inorganic fertilizers and biostimulants. The increased yield due to nitrogen application might have been utilized by the vegetative parts which, in turn, was translocated towards reproductive organs, where it combined with oxygen evolved during photosynthesis and formed amino acids. On condensation, these amino acids form proteins that ultimately increase the production of flowers and weight of the flowers. These results were in line with the findings of Beniwal et al (2005) in chrysanthemum and Anuradha et al (1990) in marigold.

Duration of flowering (80.87 days) was found to be the longest in the treatment T_6 as compared to other treatments. Muthamizhiselvi (2006) reported that the duration of flowering increased significantly with the foliar spray of Panchagavya. The increased synthesis of cytokinins and auxins in the root tissues by their enhanced activity could have been due to the application of Panchagavya along with inorganic fertilizers and their simultaneous transport to the auxillary buds would have resulted in better source mobilization of assimilates from the source to the sink at faster rate. This could have helped in early transformation from the vegetative to reproductive phase. Triggering of such metabolic processes and narrowing the C-N ratio by the significant accumulation of carbohydrates might have influenced the duration of flowering. Such long duration of flowering due to spraying of Panchagavya was also reported by Thamaraiselvi (2001) in rose and Waheeduzzama (2004) in *Anthurium*. Disease incidence was also recorded minimum (2.42%) in the same treatment T_6 as compared to all other treatments.

Earlier, Solaiappan (2002) found that in Panchagavya, proven biofertilizers such as *Azospirillum* (10^{10}), *Azotobacter* (10^9), *Phosphobacteria* (10^7) and *Pseudomonas* (10^6) were found besides *Lactobacillus*. Waheeduzzama (2004) reported that application of Panchagavya four per cent + 50 per cent RDF (17:17:17 g) favourably influenced the plant height, number of leaves, sucker production and flower yield in *Anthurium*. Naik et al (2013) reported that the media application of 1:30 Panchgavya registered highest pseudobulb length and girth and resulted in 31.66 and 41.3 per cent increase over control respectively in *Cymbidium* Sleeping Nymph. The number of spikes per plant, florets per spike, spike length and rachis length were recorded highest in the media application of Panchgavya at 1:30 and resulted in 130, 55.3, 22.4 and 26.3 per cent increase over control respectively. The Manchurian tea, which is a symbiosis of *Acetobacter xylinum* and

Saccharomyces ludwigii, is grown on black tea, which produces various acids, enzymes and some antibiotic substances.

CONCLUSION

It is quite obvious that the bio-stimulants play a surmountable role in improving the growth and quality of carnation. The pre-harvest treatment of biostimulant (Panchagavya 2% + Manchurian mushroom tea 4%) also showed low per cent of calyx splitting and enhanced the shelf-life of carnation flowers after harvest and improved the quality of flowers in the packing for long distance transport to fetch higher prices.

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