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EFFECT OF PLANT GROWTH REGULATORS ON VEGITATIVE GROWTH OF CARNATION (*DIANTHUS CARYOPHYLLUS* L.) *CV*. DOMINGO IN SECOND SEASON CROP

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Abstract

The present study was under taken in a commercial floriculture farm under protected cultivation with *cv*. domingo of carnation during July 2010 to February 2011. The experiment was laid out in randomized block design with factorial concept by using three different growth regulators at two different concentrations and applied at three different levels also compared with control. The data recorded on sprouting of buds, lateral growth and internodal length at harvest revealed that GA_3 recorded minimum number of days to bud sprout and the length of the laterals by increasing the concentration whereas NAA recorded maximum compared to control after applying the growth regulator immediately after harvesting. Benzyl adenine recorded maximum number of laterals by increasing the concentration.

Key words: Carnation, harvesting of flower stalk, GA_3, NAA, BA, growth regulators, time of spray.

Introduction

Carnation (*Dianthus caryophyllus* Linn, Fy: Caryophyllaceae), has been extensively cultivated for cut flowers in Columbia, Japan, Israel, Netherlands etc., A study indicated that about 34% of the total flower consumers expressed their liking for carnation compared to only 20% of the people who favoured roses (Staby *et al*., 1978). The maximum area under cultivation of carnation (2500 ha) is in Columbia (Bhattacharjee, 2006). In India, carnations are being grown in places like Nasik, Pune, Jammu & Kashmir, Himachal Pradesh and surrounding areas of Hyderabad in Andhra Pradesh (Mukherjee, 1996).

Application of various special horticultural practices after standardization can be one of the means to achieve the target of quality flower production. Carnation is a plurannual commercial cut flower crop exhibits apical dominance and development of lateral shoots and flower production are influenced by the presence of apical dominance (Cline, 1997). Plant growth regulators have definite influence in breaking of the auxillary bud dormancy after the harvest. Early sprouting of buds helps in getting the crop harvested early to catch the market especially during peak months. Plant growth regulators have a key role in encouraging sprouting of lateral buds which in turn helps in production of more number of flower stalks per harvested shoot.

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Materials and Methods

The experiment was laid out in randomized block design with factorial concept by using three different types of growth regulators at two different concentrations *i.e.,* gibberellic acid (150 and 250 ppm), benzyl adenine and naphthalene acetic acid (250 and 350 ppm) applied at three intervals *i.e.,* immediately, 15 and 30 days after harvesting of carnation flower stalk. Observations were recorded on number of days for sprouting of buds after harvest of flower stalk, number of buds sprouted per plant, length of lateral after harvest of flower stalk.

Results and Discussion

The data pertaining to number of days for sprouting of buds after harvest of flower stalk of carnation *cv*. Domingo are presented in table 1. There were significant differences in number of days for sprouting of buds after

harvest of flower stalk of carnation due to growth regulator treatments, time of spray and their interaction. There were significant differences due to time of spray of growth regulators after harvest of flower stalks of carnation. Growth regulators spray immediately after harvest recorded minimum number of days (10.21 days), followed by at 15 days after harvest of flower stalk (13.31 days) and maximum number of days recorded at 30 days after harvest (16.29 days).

Plant growth regulators at different concentrations also differed significantly on number of days for sprouting of buds after harvest of flower stalk of carnation. The treatment GA_3 at 250 ppm (9.16 days) recorded minimum number of days for sprouting of buds after harvest followed by BA at 350 ppm (9.98 days), GA_3 at 150 ppm (10.44 days), BA at 250 ppm (11.36 days), NAA at 250 ppm (13.55 days) and NAA at 350 ppm (18.39 days). Control recorded maximum number of days for sprouting of buds after harvest (20.01 days).

The treatment combination of GA_3 at 250-ppm (7.01 days) spray immediately after harvest recorded minimum number of days for sprouting of buds than the other treatment combinations studied, followed by BA at 250 ppm (9.02 days), NAA at 350 ppm (14.00 days) and control (15.00 days). Among the treatment combinations studied GA_3 at 250 ppm (9.41 days) at 15 days after harvest recorded minimum number of days for sprouting of buds after harvest of flower stalk. Spray of growth regulators at 30 days after harvest of flower stalk recorded maximum number of days for sprouting of buds than other time of spray of growth regulators with GA_3 at 250 ppm (11.07 days), BA at 250 ppm (13.03 days), NAA at 350 ppm (23.02 days) and control (25.00 days). The early sprouting of buds with GA_3 might be due to quick breaking down of reserved food material and increased cell elongation and cell division. These results are in conformity with Deotale *et al*. in chrysanthemum (1994) and Sen and Sen (1968) in flowering annuals.

The data pertaining to number of buds sprouted per node after harvests of flower stalk of carnation *cv*. Domingo are presented in table 2. Growth regulators spray immediately after harvest recorded maximum number of buds sprouted per node (1.29), followed by at 15 days after harvest of flower stalk (1.21) and minimum number of buds per node (1.17) was recorded with 30 days after harvest. The treatment BA at 350 ppm (1.53) recorded maximum number of buds sprouted per node after harvest followed by BA at 250 ppm (1.41) GA_3 at 250 ppm (1.26), NAA at 250 ppm (1.14) and NAA at 350 ppm (1.05). Control (1.02) recorded minimum number of buds sprouted per node after harvest of flower stalk.

Table 1: Effect of growth regulators and time of spray on number of days for sprouting of buds after harvest of carnation *cv*. Domingo.

Growth Regulators	Time of spray			
	Immediately after harvest	15 days after harvest	30 days after harvest	Mean
GA_3 @ 150 ppm	8.53[c]	10.80[b]	12.00[b]	10.44[c]
GA_3 @ 250 ppm	7.01[a]	9.41[a]	11.07[a]	9.16[a]
NAA @ 250 ppm	10.06[e]	12.59[d]	18.00[d]	13.55[e]
NAA @ 350 ppm	14.00[f]	18.16[e]	23.02[e]	18.39[f]
BA @ 250 ppm	9.02[d]	12.03[c]	13.03[c]	11.36[d]
BA@ 350 ppm	7.83[b]	10.16[b]	11.96[b]	9.98[b]
Control	15.00[g]	20.05[f]	25.00[g]	20.01[g]
Mean	10.21[a]	13.31[b]	16.29[c]	13.23
	Growth regulator (GR)	**Time of spray (T)**	**GR × T**	
F-test	*	*	*	
SEm±	0.27	0.17	0.47	
CD (5%)	0.78	0.51	1.36	

* Significant at 5% level; Figures bearing same letters did not differ significantly

The data pertaining to number of buds sprouted per harvested stalk after harvest of flower stalk of carnation *cv*. Domingo. Growth regulators spray immediately after harvest recorded maximum number of buds sprouted per harvested stalk (3.84). Plant growth regulators at different concentrations differed significantly on number of buds sprouted per stalk of carnation. The treatment BA at 350 ppm (4.47) recorded maximum number of buds sprouted per harvested stalk. All the growth regulator treatments studied recorded maximum number of buds sprouted per harvested stalk with spray immediately after harvest. The treatment combination BA at 350 ppm (4.70) spray immediately after harvest recorded maximum number of buds sprouted per harvested stalk than the other treatment combinations studied. BA recorded more number of buds per node than GA_3 due to suppression of shoot growth by increasing efficient use of photosynthates. Minimum number of buds sprouted per node with GA_3, might be due to its role in stem elongation by way of increasing internodal length, hence more utilization of photosynthates occur towards internodal elongation rather than increasing the number of laterals. These results are in conformity with Ramesh *et al.* (2001) in China aster *cv*. Kamini and Prashanth *et al.* (2006) in rose *cv*. Ice berg.

The data pertaining to length of lateral at 20 days after harvest of flower stalk of carnation *cv*. Domingo.

Table 2: Effect of growth regulators and time of spray on number of buds sprouted per node of carnation *cv*. Domingo.

Growth Regulators	Time of spray			
	Immediately after harvest	15 days after harvest	30 days after harvest	Mean
GA_3 @ 150 ppm	1.21	1.15	1.11	1.15[d]
GA_3 @ 250 ppm	1.32	1.25	1.20	1.26[c]
NAA @ 250 ppm	1.20	1.13	1.10	1.14[d]
NAA @ 350 ppm	1.12	1.03	1.01	1.05[e]
BA @ 250 ppm	11.50	1.40	1.33	1.41[b]
BA@ 350 ppm	1.63	1.52	1.43	1.53[a]
Control	1.05	1.02	1.00	1.02[e]
Mean	1.29[a]	1.21[a]	1.17[b]	1.22
	Growth regulator (GR)	**Time of spray (T)**	**GR × T**	
F-test	*	*	NS	
SEm±	0.03	0.02	0.06	
CD (5%)	0.11	0.07	—	

* Significant at 5% level; Figures bearing same letters did not differ significantly

Table 3: Effect of growth regulators and time of spray on length of lateral (cm) at 80 days after harvest of carnation *cv*. Domingo

Growth Regulators	Time of spray			
	Immediately after harvest	15 days after harvest	30 days after harvest	Mean
GA_3 @ 150 ppm	52.48[b]	46.80[b]	42.50[c]	47.26[c]
GA_3 @ 250 ppm	54.62[a]	51.50[a]	47.73[a]	51.28[a]
NAA @ 250 ppm	48.41[d]	44.20[c]	38.70[e]	43.77[e]
NAA @ 350 ppm	44.03[e]	36.72[d]	32.62[f]	37.79[f]
BA @ 250 ppm	50.51[c]	44.78[c]	40.75[d]	45.34[d]
BA@ 350 ppm	52.71[b]	50.59[e]	43.91[b]	49.07[b]
Control	1.05	1.02	1.00	1.02[e]
Mean	39.50[f]	35.51[d]	32.71[f]	36.31[g]
	Growth regulator (GR)	**Time of spray (T)**	**GR × T**	
F-test	*	*	*	
SEm±	0.34	0.22	0.60	
CD (5%)	0.99	0.64	1.71	

* Significant at 5% level; Figures bearing same letters did not differ significantly

There were significant differences due to time of spray of growth regulators after harvest of flower stalks of carnation. Growth regulators spray immediately after harvest recorded maximum length of lateral at 20 days after harvest of flower stalk (3.75 cm). The treatment GA_3 at 250 ppm (4.03 cm) recorded maximum length of lateral at 20 days after harvest of flower stalk followed by BA at 350 ppm (3.74 cm). The treatment combination of GA_3 at 250 ppm (5.60 cm) spray immediately after harvest recorded maximum length of lateral at 20 days after harvest of flower stalk than the other treatment combinations studied.

The data pertaining to length of lateral at 30 days after harvest of flower stalk of carnation *cv*. Domingo. The treatment GA_3 at 250 ppm (8.05 cm) recorded maximum length of lateral at 30 days after harvest of flower stalk followed by BA at 350 ppm (7.81 cm). The treatment combination of GA_3 at 250 ppm (11.21 cm) spray immediately after harvest recorded maximum length of lateral at 30 days after harvest of flower stalk.

The data pertaining to length of lateral at 40 days after harvest of flower stalk of carnation *cv*. Domingo. The interaction between growth regulator treatments and time of spray differed significantly on length of lateral at 40 days after harvest of flower stalk of carnation. All the growth regulator treatments studied recorded maximum length of lateral at 40 days after harvest of flower stalk with spray immediately after harvest. The treatment combination of GA_3 at 250 ppm (20.50 cm) spray immediately after harvest recorded maximum length.

The data pertaining to length of lateral at 80 days after harvest of flower stalk of carnation *cv*. Domingo are presented in table 3. Growth regulators spray immediately after harvest recorded maximum length of lateral at 80 days after harvest of flower stalk (48.89 cm), followed by at 15 days after harvest of flower stalk (44.30 cm) and at 30 days after harvest recorded minimum length of lateral at 80 days after harvest of flower stalk (39.84 cm). The treatment GA_3 at 250 ppm (51.28 cm) recorded maximum length of lateral at 80 days after harvest of flower stalk followed by BA at 350 ppm (49.07 cm). All the growth regulator treatments studied recorded maximum length of lateral at 80 days after harvest of flower stalk with spray immediately after harvest. The treatment combination of GA_3 at 250 ppm (54.62 cm) spray immediately after harvest recorded maximum length, followed by BA at 250 ppm (50.51 cm), NAA at 350 ppm (44.03 cm) and control (39.50 cm).

Singh *et al.* (1994) suggested that this increase in shoot length may be attributed to physiological action of GA_3. GA_3 increases the size of meristamatic region as well as proportion of cells undergoing cell elongation and

cell division, cell enlargement, increased plasticity of cell, promotion of protein synthesis coupled with higher apical dominance. The probable mechanism of stem length increase by GA_3 is the increase in auxin content of the tissues. Narayana Gowda and Jayanthi (1986) stated that GA_3 at 200-250 ppm increased shoot length in rose *cv*. Super Star. Sadanand *et al*. (2000) also reported that maximum shoot length with GA_3 in rose *cv*. First Red. Sable *et al*. (1992) on rose *cv*. Paradise and Bhattacharjee (1992) on rose *cv*. Raktagandha also reported similar results.

The data pertaining to internodal length of lateral at time of harvest after harvest of flower stalk of carnation *cv*. Domingo. Growth regulators spray immediately after harvest recorded maximum internodal length of flower stalk at the time of harvest (7.16 cm), followed by at 15 days after harvest of flower stalk (7.01 cm) and at 30 days after harvest recorded minimum number of buds per node (6.88 cm). The treatment GA_3 at 250 ppm (7.75 cm) recorded maximum internodal length of flower stalk followed by GA_3 at 150 ppm (7.64 cm), BA at 350 ppm (7.44 cm), BA at 250ppm (7.26 cm), NAA at 250 ppm (6.56 cm) and NAA at 350 ppm (6.34 cm). Control recorded minimum internodal length of flower stalk at the time of harvest (6.13 cm).

The increase may have happened due to an increase in cell elongation, cell division or both. Misra and singh (1977) stated that elongation of internodes was more pronounced in plants treated with GA_3 compared to control in pansy. Reddy and Sulladmath (1978) also observed with GA_3 at 300 ppm, increased the internodal length in China aster. Similar results were reported by Singh *et al.* (1994) in Dahlia.

Conclusion

Among the growth regulators studied GA_3 recorded minimum number of days to bud sprout by increasing the concentrations from 150 to 250 ppm whereas NAA recorded maximum number of days to bud sprout than control. GA_3 also promoted early flowering. Floral characters such as flower stalk length, flower length, flower diameter and fresh weight of flower were maximum with GA_3. BA significantly increased the number of flower stalks harvested per plant and recorded maximum vase life of cut flower.

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