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Short Research Article

Effect of Plant Growth Regulators and Pinching on Garland Chrysanthemum (*Dendranthema grandiflora* Tzvelev)

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Abstract

Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is one of the most important flower crop grown commercially throughout India. Plant growth regulators have great potential to influence plant growth and yield by judicious planning of the type of PGR and its optimal concentrations. Similarly, pinching is also known to significantly influence flowering and yield. Both PGRs and pinching have been known to affect growth and yield of chrysanthemum. But information regarding their use in combination is lacking. Keeping these points in view, the present experiment was carried out at Horticultural Research and Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during *rabi* season of 2012−13. The experiment was laid out in Randomized Block Design with three replications. The treatments consisted of fourteen combinations of three plant growth regulators (GA_3, MH and CCC) at different concentrations without and with pinching (P) including control (water spray). Data on various growth and flowering parameters were recorded. The results revealed that maximum plant height, earliest days to flower and shelf life was recorded on the application of GA_3 (200 ppm) whereas, maximum number of leaves plant^{-1} was recorded with GA_3 (200 ppm) alongwith pinching. Maximum plant spread and number of secondary branches plant^{-1} was observed on the application of CCC (1500 ppm) alongwith pinching. Maximum primary branches plant^{-1}, period of flowering, number of flowers plant^{-1} and flower yield was obtained on the application of MH (750 ppm) alongwith pinching. However, maximum flower diameter was noticed with MH (750 ppm).

1. Introduction

Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is one of the most important flower crop belonging to family Asteraceae and is also commonly known as "Glory of the East". It occupies second position in world flower trade after rose and carnation and third position in India after jasmine and rose. In India, it is popular as loose flower, mainly grown commercially by farmers for making garlands and religious offerings. Out of total area of 10699 ha under floriculture, the estimated area of chrysanthemum under Chhattisgarh state is about 287 ha with a production of 1145 MT (Chhattisgarh Horticulture, 2016).

The commercial cultivation of chrysanthemum with good quality flowers and higher yield is needed for consumption in local market and to provide livelihood especially to the marginal and small farmers. Plant growth regulators (PGRs) are now being commonly used for inducing more acceptable plant characteristics like compact growth, dwarfness, increased number of healthy branches and promote flower initiation (Banon et al., 2002). Similarly, pinching of apical bud has a significant influence on flowering and yield. Thus, growth regulators and pinching can play an important role in the improvement of flowering and yield of Chrysanthemum. Keeping in view the above points the present experiment was undertaken to compare the effects of growth regulators and hand pinching for higher flower yield in chrysanthemum.

2. Materials and Methods

2.1. Study site

The present investigation was conducted at the Horticultural Research and Instructional Farm, Department of Horticulture, College of Agriculture, Indira Gandhi Agricultural University,

Raipur, Chhattisgarh, during the rainy season of 2012−2013.

2.2. Treatment and method of data collection

The experiment consisted of fourteen treatments comprising of plant growth regulators and pinching (P) viz., GA_3 (100 ppm), GA_3 (200 ppm), GA_3 (200 ppm)+P, MH (550 ppm), MH (550 ppm)+P, MH (750 ppm), MH (750 ppm)+P, CCC (1000 ppm), CCC (1000 ppm)+P, CCC (1500 ppm), CCC (1500 ppm)+P including water spray+P and water spray, as control laid out in Randomized Block Design. The treatments were imposed in the form of foliar sprays with a spray fluid volume of 250 ml on 30th day after planting. Good quality rooted cuttings of chrysanthemum cultivar White Decorative was planted in the field having individual plot size of 1.5×1.2 m^2 with a spacing of 30×30 cm^2. Pinching was carried out 20 days after planting. Full dose of phosphorus and potash and half of total nitrogen was applied as basal to the crop at the time of planting. The remaining half dose of nitrogen was applied after pinching. The current recommended agronomic package of practices was followed during the course of investigation. Observations were recorded on five randomly selected plants from each treatment after full growth of plant and were subjected to statistical analysis using SPSS (SPSS Inc., USA) 10.0 statistical software.

3. Results and Discussion

3.1. Growth parameters

Significant variation was observed for vegetative growth parameters on the application of PGRs and pinching (Table 1). Maximum plant height (49.40 cm) was recorded on the application of GA_3 (200 ppm). However, taller plants were observed on the foliar spray of GA_3 irrespective of their concentration or pinching as compared to other treatments, except water spray (control). In general, treatments including pinching resulted in reduced plant height. The maximum plant spread (34.30 cm) was recorded in the treatment CCC (1500 ppm)+P followed by MH (750 ppm)+P and foliar application of MH (750 ppm). Increased in the plant spread may be due to suppression of apical dominance by higher concentration of PGRs or pinching that produced greater number of lateral branches, resulting in increased plant spread (Vaghasia and Polara, 2015). These finding are in accordance with the findings of Meher et al. (1999); Navale et al. (2010) in chrysanthemum. Significantly more number of leaves $plant^{-1}$ was observed with higher concentration of GA_3 as compared to rest of the treatments. Maximum number of leaves $plant^{-1}$ (52.87) was recorded with GA_3 (200 ppm)+P. Maximum number of primary branches (17.44) was recorded with MH (750 ppm)+P which, however, was at par with MH (750 ppm) but significantly superior over other treatments. With regard to secondary branches, maximum number of secondary branches $plant^{-1}$ (9.95) was observed with CCC (1500 ppm)+P. MH may have increased the primary number of branches by retarding the apical growth (Ahmad et al., 2007) and inducing the lateral growth (Vaghasia and Polara, 2015). The present results are in conformity with the findings of Moond et al. (2006) in chrysanthemum.

3.2. Flowering and yield parameters

Flowering parameters showed significant variation with different treatments (Table 2). Minimum days taken to first flowering (57.71 days) were recorded with GA_3 (200 ppm). Pinching operation delayed the first flowering irrespective of

Table 1: Effect of PGRs and pinching on growth parameters of garland chrysanthemum

Treatments	Plant height (cm)	Plant spread	No. of leaves	No. of primary branches	No. of secondary branches
GA_3 (100 ppm)	49.12	21.17	47.12	10.49	6.45
GA_3 (100 ppm)+P	48.84	25.78	49.53	11.20	6.92
GA_3 (200 ppm)	49.40	23.84	51.07	11.58	7.40
GA_3 (200 ppm)+P	49.12	26.68	52.87	12.42	7.53
MH (550 ppm)	42.00	27.54	41.77	13.53	7.43
MH (550 ppm)+P	41.48	28.21	44.47	14.47	9.34
MH (750 ppm)	41.34	29.31	43.23	15.42	8.48
MH (750 ppm)+P	40.36	29.98	44.83	17.44	9.49
CCC (1000 ppm)	40.44	31.07	39.03	12.57	8.32
CCC (1000 ppm)+P	40.14	32.26	39.13	12.83	8.49
CCC (1500 ppm)	38.36	30.17	35.63	12.49	9.44
CCC (1500 ppm)+P	35.01	34.30	37.57	13.50	9.95
Water spray+P	43.21	22.67	33.00	13.50	5.40
Water spray	47.84	15.17	32.37	7.59	4.42
SEm±	2.094	1.949	2.064	1.183	0.788
CD (p=0.05)	5.759	5.712	5.723	3.279	2.184

Table 2: Effect of PGRs and pinching on flowering and yield parameters of garland chrysanthemum

Treatments	Days to first flowering	Period of flowering (days)	No. of flowers plant^{-1}	Flower diameter (cm)	Flower yield plant^{-1} (g)	Flower yield (t ha^{-1})	Shelf life of flowers (days)
GA_3 (100 ppm)	59.52	60.37	32.59	2.83	65.35	7.25	3.77
GA_3 (100 ppm)+P	65.47	64.41	34.59	2.53	72.42	8.04	4.37
GA_3 (200 ppm)	57.71	67.41	36.79	3.79	94.86	10.53	4.87
GA_3 (200 ppm)+P	66.62	70.37	39.51	2.96	94.51	10.50	4.70
MH (550 ppm)	57.77	72.39	36.40	3.51	66.42	7.37	4.57
MH (550 ppm)+P	69.51	80.74	39.44	3.14	63.43	7.04	4.53
MH (750 ppm)	59.36	76.30	40.87	4.76	101.77	11.30	4.63
MH (750 ppm)+P	69.67	80.45	42.26	3.57	114.75	12.75	4.47
CCC (1000 ppm)	63.47	69.82	28.49	3.08	39.32	4.36	3.40
CCC (1000 ppm)+P	71.45	74.45	30.79	2.52	37.42	4.15	2.80
CCC (1500 ppm)	71.13	65.68	21.92	2.62	25.33	2.81	3.63
CCC (1500 ppm)+P	67.70	72.15	22.88	2.50	25.66	2.85	3.60
Water spray+P	72.62	56.38	20.46	2.41	20.88	2.32	2.97
Water spray	65.48	55.02	19.73	2.75	22.35	2.48	2.80
SEm±	2.016	2.622	1.913	0.291	5.97	0.66	0.439
CD (p=0.05)	5.189	7.269	5.308	0.808	16.572	1.84	1.217

the PGR and its concentration whereas, higher concentration of PGRs might have induced formation of reproductive primordia. Pinching is known to promote vegetative growth which might have delayed the reproductive phase and hence the delay in days to first flowering. Contrary to this, period of flowering (blooming days) increased with the pinching operation, maximum (80.45 days) being recorded in the treatment MH (750 ppm)+P. This may be due to difference in the emergence timings of the shoots after pinching, resulting in variation of blooming period. Maximum number of flowers plant^{-1} (42.26) was recorded with MH (750 ppm)+P. In general it is observed that increase in number of flowers was directly proportional to the increase in number of primary branches plant^{-1}. Pinching and higher concentration of PGRs checked the apical dominance and diverted extra metabolites into the production of more number of flowers. These results are in line with the findings of Pushkar and Singh (2012) in marigold and Ahmad et al. (2007) in carnation. Significantly maximum flower diameter (4.76 cm) was recorded on the foliar spray of MH (750 ppm) followed by GA_3 (200 ppm). Higher concentration of PGRs and pinching might have induced more branching but may have resulted in small sized flowers due to diversion of photosynthates to a large number of shoots (Ahmad et al., 2007). Similar findings were recorded in chrysanthemum (Adriansen, 1985 and Patanwar et al., 2015). Maximum flower yield (Plant^{-1} and ha^{-1}) was reported with MH (750 ppm)+P (114.75 g and 11.30 t ha^{-1}, respectively) followed by MH (750 ppm). Increase in flower yield might be due to suppression of apical dominance resulting in more number of primary and secondary branching, thereby increasing the flower number which ultimately resulted in increased yields of flowers (Vaghasia and Polara, 2015). Highest shelf life of flower was recorded in GA_3 (200 ppm). Similar results have been obtained by Navale et al. (2010) in chrysanthemum.

4. Conclusion

Chrysanthemum growth, flowering parameters and yield was higher on application of PGRs along with pinching except for characters viz., plant height, earliest days to flower, shelf life and flower diameter, where application of PGR alone was found to be more effective as compared to PGR along with pinching. Yield and yield attributing parameters viz., maximum number of primary branches plant^{-1}, period of flowering, number of flowers plant^{-1} and flower yield were obtained on the application of MH (750 ppm) along with pinching.

5. References

Adriansen, E., 1985. Retardation of pedicel length with ancymidol, piproctanyl bromide and daminozide in nine cultivars of spray chrysanthemum. Tidsskrift plantearl 89, 435–443.

Ahmad, I., Ziaf, K., Qasim, M., Tariq, M., 2007. Comparative evaluation of different pinching approaches on vegetative

and reproductive growth of carnation (*Dianthus caryophyllus*). Pakistan Journal of Agriculture Sciences 44(4), 563–570.

Banon, S.A., Gonzalez, E.A., Cano, J.A., Franco, J.A., Fernandez., 2002. Growth, development and colour response of potted *Dianthus caryophyllus* cv. Mondriaan to paclobutrazol treatment. Scientia Horticulturae 94, 371–377.

Chhattisgarh Horticulture., 2016. Statistics: At a glance. Directorate of Horticulture, Raipur, Government of Chhattisgarh. Available from www.cghorticulture.gov.in /statistics.htm.

Meher, S.P., Jiotode, D.J., Turkhede, A.B., Darange, S.O., Ghatol, P.U., Dhawad, C.S., 1999. Effect of planting time and growth regulator treatments on flowering and yield of chrysanthemum. Crop Research, Hissar 18(3), 345–348.

Moond, S.K., Khandelwal, S.K., Virendra. S., Rakesh., 2006. Effect of GA_3, CCC and MH on quality and yield of flowers in chrysanthemum. Crop Research, Hissar 32(1), 63–65.

Navale, M.U., Aklade, S.A., Desai, J.R., Nannavare, P.V., 2010. Influence of plant growth regulators on growth, flowering and yield of chrysanthemum (*Dendrathema grandiflora* Tzvelev) cv. 'IIHR-6'. International Journal of Pharma and Bio Sciences 1(2), 1–4.

Patanwar, M., Sharma, G., 2015. Flowering attributes and yield of Chrysanthemum (*Dendranthema grandiflora* Tzvelev) as influenced by integrated nutrient management. Ecology, Environment & Conservation 21(1), 385–388.

Pushkar, N.C., Singh, A.K., 2012. Effect of pinching and growth retardants on flowering and yield of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. International Journal of Horticultural Sciences 2(1), 1–4.

Vaghasia, M., Polara, M.D., 2015. Effect of plant growth retardants on growth, flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. IIHR-6. Malaysian Journal of medical and biological research 2(5), 161–166.