International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 2542-2545

Received: 16-05-2019
Accepted: 18-06-2019

Gurudutt Ojha
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Urfi Fatmi
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Devi Singh
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Correspondence
Gurudutt Ojha
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Response of gerbera (*Gerbera jamesonii* Bolus) to growth retardants for growth, flower yield and quality under naturally ventilated polyhouse conditions

Gurudutt Ojha, Urfi Fatmi and Devi Singh

Abstract
Gerbera is the one of the important cut flower in the international flower market. In this experiment 'Szogun' and 'Marzena' varieties were treated with growth retardants, CCC (250ppm, 500ppm and 750ppm) and MH (750ppm, 1000ppm and 1250ppm). An experiment entitled Response of Gerbera (Gerbera jamesonii Bolus) to growth retardants for growth, flower yield and quality under naturally ventilated poly house condition was conducted at Horticulture Research Field, Department of Horticulture, during the year 2018-2019. The experiment was laid out in Factorial Randomized Block Design having 14 treatments T_1 (Control + Szogun),T_2(MH@250ppm + Szogun), T_3 (MH@500ppm + Szogun), T_4(MH@ 750ppm + Szogun), T_5(CCC@750ppm + Szogun), T_6(CCC@1000ppm + Szogun), T_7(CCC@1250ppm + Szogun),T_8 (Control + Marzena),T_9(MH@250ppm + Marzena), T_{10}(MH@500ppm + Marzena), T_{11}(MH@ 750ppm + Marzena), T_{12}(CCC@750ppm + Marzena), T_{13}(CCC@1000ppm + Marzena), T_{14}(CCC@1250ppm + Marzena) with three replications. The result revealed that treatment T_1 (Control + Szogun) was best in terms of maximum plant height (23.79 cm), plant spread (32.35 cm), number of leaves (15.33). The treatment T_{14} (CCC @ 1250ppm + Marzena) was found superior in most of the flower qualities like number of flower per plant (11), days of first flower bud emergence (76.08 days), flower diameter (12.06 cm), stalk girth (1.88 cm), stalk length (46.43 cm) and vase life of the flower (9.13 days).

Keywords: Gerbera, cycocel (CCC) and maliec hydrazide (MH)

Introduction
Gerbera (*Gerbera jamesonii* Bolus), a beautiful daisy, belongs to the family *Compositae*. It is a native of South Africa and Asia, and has acquired commercial importance in recent years. This plant is named in the honor of German naturalist *Traugott Gerber*, and known as *Transvaal* or *Barbeton daisy*. Some of them show excellent agronomic characters such as flower colour, floral diameter, vigour, and stem length.

This plant is widely commercially produced by the floral industry both as cut flower and potted plant. The flowers are hardy and can withstand vigorous transportation. They have long-keeping quality and fetch high market price. Plant growth regulators also influence the vegetative growth and flowering in gerbera like using plant growth retardants in gerbera that induce flowering in plant and hence increase the aesthetic value of gerbera and helps to produce standard quality flowers for market.

Plant growth retardants are synthetic compounds used to retard the shoot length of plants in a desired way without changing developmental patterns or evoke phytotoxic effects. This has been achieved not only by reducing cell elongation but also by lowering the rate of cell division and regulating the plant height physiologically. Most plant growth retardants inhibit the formation of growth-active gibberellins (GAs) and can thus be used to reduce unwanted shoot elongation. Plant growth retardants have been variously used in ornamental horticultural practices.

Maleic hydrazide is usually defined chemically as 1, 2- dihydro-3,6-pyridazinedione. Maleic hydrazide is plant growth retardant, which inhibits plant cell division but not enlargement of the existing cells. When applied in plants it moved through cuticles and reach to the tissue where cell division occurs. Maleic hydrazide is freely translocated in plants, with mobility in both xylem and phloem.

It is used to control sprouting, growth of weeds and grasses in ornamental plants.

Chlormequat chloride (commonly known as Cycocel) is another very popular PGR. Unlike chlormequat chloride inhibits GA production early in the process. It has activity when appliedto both the leaves and the roots, but it is primarily applied as a foliar spray due to the higher concentrations required for adequate control whenapplied as a drench.

Materials and Methods

The Experiment was conducted in Factorial Randomized Block Design (FRBD) with the two factors i.e, Varieties (Szogun and Marzena)and growth retardants (CCC and MH), where varities treated with different concentrations of CCC and MH under poly house conditions includes 14treatments with three replications *viz.* T_1(Control + Szogun), T_2(MH @ 250ppm + Szogun), T_3(MH @ 500ppm + Szogun), T_4(MH @ 750ppm + Szogun), T_5(CCC @ 750ppm + Szogun), T_6(CCC @ 1000ppm + Szogun), T_7(CCC @ 1250ppm + Szogun), T_8(Control + Marzena), T_9(MH @ 250ppm + Marzena), T_{10}(MH @ 500ppm + Marzena), T_{11}(MH @ 750ppm + Marzena), T_{12}(CCC @ 750ppm + Marzena), T_{13}(CCC @ 1000ppm + Marzena), T_{14}(CCC@1250ppm + Marzena).

Results and Discussion

Growth Parameters

In terms of Plant height (23.80cm), plant spread (32.35cm) and Number of leaves (15.33) were recorded maximum in treatment T_1 (Control + Szogun) where as minimum plant height (17.31cm) was recorded in treatment T_{14} (CCC + Marzena), minimum plant Spread (24.01cm) was recorded in treatment T_7 (CCC + Szogun) and minimum Number of leaves (9.51) was recorded in treatment T_{13} (CCC + Marzena). The difference in these growth parameters with the type and concentration of growth retardants may be due to their different mode of action in inhibiting plant growth regulators particularly gibberellins and auxins as explained by Warner and Erwin (2003). At low concentrations, growth retardants typically reduce cell elongation, whereas at high concentrations the reduction is increased due to a retard cell division (Grossman, 1992) [7]. The drastically retarded growth with application of MH @ 250ppm, 500ppm, 750ppm and Cycocel @ 750ppm, 1000ppm and 1250ppm may be due to its very high concentrations, which has more inhibitory role on cell division and cell elongation of apical meristematic cells and also on gibberellins synthesis. Similar results were found in annual carnation (Foley and Keever, 1991) [5] and marigold (Latimer, 1991).

The present investigation showed that minimum days to first flower bud emergence (76.08 days) was recorded in T_{14} (CCC @ 1250ppm + Marzena) followed by T_{13} (CCC @ 100ppm + Marzena) (78.75 days). However, a maximum day to first flower bud emergence (83.75 days) was observed inT_8 Control + Marzena). These results may be due to the fact that plants treated with growth retardants have built up sufficient food reserves at initial stages due to suppression of apical dominance, increased number of leaves and mobility of photosynthates from source to sink. This reserve food has been utilized for reproductive purpose with a restriction on vegetative growth which decreases days to flowering. These results were in close agreement with Dutta *et al.* **(**1993) [4] in chrysanthemum and Kumar and Kumar (2004) [10] in balsam.

Quality Parameters

In terms of Flower diameter, treatment T_{14} (CCC@1250ppm + Marzena) recorded maximum (12.06 cm) followed by T_{11} (CCC @ 750ppm + Marzena) with (10.38 cm), whereas minimum Flower diameter (8.58 cm) was recorded in treatment T_1 (Control + Szogun). These results may be due to the fact that plants treated with growth retardants have built up sufficient food reserves at initial stages due to suppression of apical dominance, increased number of leaves and mobility of photo synthates from source to sink. This reserve food has been utilized for reproductive purpose with a restriction on vegetative growth which decreases days to flowering and improves the flower qualities. These results were in close agreement with Dutta *et al.* **(**1993) [4] in chrysanthemum.

In terms of stalk length (46.43 cm) and stalk girth (1.88 cm) were recorded maximum in treatment T_{14} (CCC@1250ppm + Marzena) whereas minimum stalk length (24.95 cm) was recorded in treatment T_6 (CCC @ 100ppm + Szogun) and minimum stalk girth (0.82 cm) was recorded in treatment T_1 (Control + Szogun). This enlargement is caused by drawing of photo synthates to the flower as a consequence of intensification of the sink. Further, other scientists have reported suppression in vegetative parameters with the application of growth retardants but not on flowering parameters (Lee and Suh, 2005; Anburani and Ananth, 2008; Saikia and Talukdar, 1998; Kazaz *et al.*, 2010 and Khan and Tewari, 2003) [11, 1, 8, 9].

In terms of Vase Life, treatment T_{14} (CCC @ 1250ppm + Marzena) recorded maximum (9.13 days) followed by T_7 (CCC @ 1250 + Szogun) with (9.06 days), whereas minimum vase life (7.00 days) was recorded in Control group. Application of MH and CCC also increased vase life of gerbera stalk. Increased vase life might be due to reduced physiological weight loss. Restricted respiration due to inhibitory action of growth retardants might have increased the vase life. It alsomight be due to the maximum number of florets and longest stalk. Similar findings were also obtained by Dutta *et al.* (1993) [4] and Talukdar and Paswan (1997) [16] in chrysanthemum.

Yield Parameters

In terms of flower yield/plant, treatment T_{14} (CCC @ 1250ppm+ Marzena) recorded maximum (11.00) followed by T_7 (CCC @ 1250ppm + Szogun) with (10.33), whereas minimum flower yield/plant (7.16) was recorded in treatment T_9 (MH @ 250ppm + Marzena).

In terms of Flower yield/200 sq m, treatment T_{14} (CCC @ 1250ppm + Marzena) recorded maximum (22,003) followed by T_{13} (CCC@1000ppm + Marzena) with (21,567), whereas minimum flower yield/200 sq m. (17,040) was recorded in treatment T_8 (Control + Marzena). These results may be due to the fact that plants treated with growth retardants have built up sufficient food reserves at initial stages due to suppression of apical dominance, increased number of leaves and mobility of photosynthates from source to sink. This reserve food has been utilized for reproductive purpose with a restriction on vegetative growth which decreases days to flowering and improves the flower qualities. These results were in close agreement with Dutta *et al.* **(**1993) [4] in chrysanthemum.

Conclusion

It is concluded that among the growth retardants and their concentrations the suitable concentration of growth retardant for growth, flower yield and quality of gerbera is Cycocel @ 1250ppm. The interaction effect reveals that plant height,

plant spread and number of leaves was recorded maximum in T_1 (Control + Szogun), while T_{14} (CCC@1250ppm + Marzena) was found superior in most of the flower qualities (Flower diameter, stalk length, stalk girth and vase life). Flower yield per plant (11), flower yield per 200 sq. m (22,003) and cost benefit ratio (1:2.17) were recorded maximum in T_{14} (CCC@1250ppm + Marzena).

Table 1: Growth parameters of Gerbera as influenced by different concentration of growth retardants

Varieties	Plat height (cm)			Plant spread (cm)			Number of leaves			First flower bud emergence		
Concentration	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**
Control	23.79	21.98	22.88	32.35	32.01	32.18	15.33	14.83	15.08	82.12	83.75	82.93
MH @ 250ppm	20.91	20.92	20.91	29.07	26.68	27.87	15.02	13.58	14.30	80.27	80.16	80.21
MH @ 500ppm	20.15	21.05	20.60	27.15	28.18	27.66	14.08	12.66	13.37	80.36	80.08	80.22
MH @ 750ppm	20.14	20.39	20.26	24.35	26.96	25.65	11.08	12.08	11.58	79.41	78.69	79.05
CCC @ 750ppm	19.99	20.03	20.01	26.31	27.39	26.85	11.25	11.08	11.16	79.16	81.18	80.17
CCC @ 1000ppm	18.92	17.70	18.31	25.73	26.14	25.93	10.83	9.51	10.17	79.65	78.75	79.20
CCC @ 1250ppm	17.44	17.31	17.37	24.01	24.67	24.34	9.58	10.00	9.79	78..83	76.08	77.45
Mean A	20.19	19.91		26.94	27.48		12.45	11.96		79.97	79.81	
Comparison	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**
Factor A	S	0.13	0.27	S	0.15	0.31	S	0.14	0.31	S	0.19	0.40
Factor B	S	0.24	0.50	S	0.28	0.59	S	0.27	0.57	S	0.36	0.75
Factor (A×B)	S	0.34	0.71	S	0.40	0.83	S	0.39	0.81	S	0.52	1.07

Table 2: Quality parameters of Gerbera as influenced by different concentration of growth retardants

Varieties	Flower diameter (cm)			Stalk length (cm)			Stalk girth (cm)			Vase life (days)		
Concentration	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**
Control	8.58	9.76	9.17	39.91	37.74	38.82	0.82	1.22	1.02	7.00	7.00	7.00
MH @ 250ppm	8.39	9.60	8.99	32.67	40.23	36.45	0.83	1.52	1.17	7.26	7.20	7.23
MH @ 500ppm	9.90	8.94	9.42	43.97	35.33	39.65	0.85	1.80	1.32	7.40	7.80	7.60
MH @ 750ppm	8.20	10.38	9.29	30.22	38.52	34.37	0.94	1.20	1.07	7.80	8.13	8.13
CCC @ 750ppm	8.94	9.90	9.42	32.97	40.13	36.55	1.28	0.93	1.10	8.00	8.30	8.30
CCC @ 1000ppm	8.36	10.17	9.27	24.95	39.83	32.39	1.05	1.44	1.24	8.80	8.86	8.86
CCC @ 1250ppm	9.99	12.06	11.03	37.23	46.43	41.83	1.40	1.88	1.64	9.07	9.10	9.10
Mean A	8.91	10.12		34.56	39.74		1.02	1.43		7.90	8.16	
Comparison	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**
Factor A	S	0.03	0.07	S	0.04	0.10	S	0.02	0.04	S	0.06	0.13
Factor B	S	0.07	0.14	S	0.09	0.18	S	0.04	0.09	S	0.11	0.24
Factor (A×B)	S	0.10	0.21	S	0.12	0.26	S	0.06	0.12	S	0.16	0.34

Table 3: Yield parameters in Gerbera as influenced by different concentration of growth retardants

Varieties	Flower yield/ plant			Flower yield/ 200 sq m		
Concentration	**Szogun**	**Marzena**	**Mean B**	**Szogun**	**Marzena**	**Mean B**
Control	8.16	7.38	9.17	17.34	17.04	17.19
MH @ 250ppm	8.08	7.16	8.99	17.95	17.86	17.91
MH @ 500ppm	8.40	8.31	9.42	18.22	18.44	18.33
MH @ 750ppm	9.28	8.58	9.29	19.08	19.54	19.31
CCC @ 750ppm	8.74	9.50	9.42	19.68	20.99	20.33
CCC @ 1000ppm	8.99	9.08	9.27	20.69	21.56	21.12
CCC @ 1250ppm	10.33	11.00	10.66	21.18	22.00	21.59
Mean A	8.85	8.71		19.16	19.63	
Comparison	**F-test**	**S. Ed**	**C.D at 5%**	**F-test**	**S. Ed**	**C.D at 5%**
Factor A	S	0.11	0.23	S	0.07	0.13
Factor B	S	0.21	0.43	S	0.12	0.25
Factor (A×B)	S	0.29	0.61	S	0.17	0.36

References

1. Anburani A, Ananth AV. Effect of growth retardants on growth and yield in nerium (*Nerium odorum*). J Ornam. Hort. 2008; 11:298-301.
2. Bayaskar Snehal, Gawai YR. Effect of Cycocel on Varieties of Chrysanthemum for Growth and Flower Yield, Int. J Pure App. Bio sci. 2018; 6(5):467-471
3. Dani KN, Patil SJR, Patel G, Patel NA. Effect of growth retardants on flwering and yield od of African marigold (*Tagetes erecta* L.) cv. Double Orange under south Gujrat conditions. Asian J Hort. 2010; 5(2):287-290
4. Dutta JP, Seemanthini R, Khader MA. Regulation of flowering by growth regulators in chrysanthemum (*Chrysanthemum indicum* L.) cv. 'Co-1'. South Indian Hort. 1993; 41:293-99.
5. Foley JT, Keever GJ. Growth regulators and pruning alter growth and axillary shoot development of dianthus. J Environ. Hort. 1991; 9:191-95.
6. Girisha R, Shiroll AM, Kulkarni BS, Reddy BS, Anupa T. Studies on effect of different plant growth regulators on growth, flowering and quality of daisy (*Aster amellus* L.) cv. Dwarf Pink. Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, 2013, 591-310

7. Grossman K. Plant growth retardants: Their mode of action and benefit for physiological research. Kluwer Academic Publ., Dodrecht, Neatherland, 1992, 788-797p.
8. Kazaz S, Askin MA, Kilic S, Ersoy N. Effects of day length and daminozide on the flowering, some quality parameters and chlorophyll content of *Chrysanthemum morifolium* Ramat. Sci. Res. and Essays. 2010; 5(21):3281-3288.
9. Khan FU, Tewari GN. Effect of growth regulators on growth and flowering of dahlia (*Dahlia variabilis* L.). Indian J Hort. 2003; 60(2):192-194.
10. Kumar J, Kumar S. Effect of maleic hydrazide on growth and flowering in balsam (*Impatiens balsamina* L.). J Ornam. Hort. 2004; 7:129-30.
11. Lee KH, Suh JK. Effects of nutrient solution composition and plant growth retardants on growth and flowering in hydroponics of cut tulip. Acta Hort. 2005; 673:519-23.
12. Naidu JH, Ashok P, Chandrashekhar R, Sasikala K. Effect of plant growth retardants and spacings on vegetative growth and flower yield of African marigold (*Tagetes erecta* L) cv Pusa Narangi Gainda. Int. J Farm Sci. 2014; 4(2):92-99.
13. North J, Laubscher CP, Ndakidem PA. Affect of the growth retardant Cycocel in controlling the growth of *Dombeya burgessiae*, African J Biotech. 2010; 9(29):4529-4533
14. Sunayana S. Effect of growth retardants (Alar and Cycocel) on flower yield and carotenoid content in African marigold (*Tagetes erecta* L.) varieties, J Trop. Agric. 2017; 55 (2):205-208, 201
15. Saikia M, Talukdar MC. Effect of B-9 and MH on the growth and flowering of pinched and unpinched chrysanthemum (*Dendranthema grandiflora* Tzvelev). J Ornam. Hort. 1997; 5(1-2):16-19.
16. Talukdar MC, Paswan L. Effect of GA3 and CCC ongrowth and flowering of standard chrysanthemum. J Ornam. Hort. 1997; 1:11-16.