

Use of Growth Retardant on Classic Zinnia (*Zinnia angustifolia* Kunth) to Make Commercial Pot Plant

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ABSTRACT

This study was conducted to improve the potential of *Zinnia angustifolia* Kunth as pot plant. Paclobutrazol was used to make plants more compact and decrease its size to fit the 4-inch pot. It was effective in regulating the plant height and size. The change of growth retardant concentration while the plant was growing up increased their effectiveness in regulating the plant height, size and other aesthetic characteristics related to pot size. Using paclobutrazol at 10 ppm on 21-day-old plant 4 times and changing to 25 ppm 3 times gave the best result for *Zinnia angustifolia* Kunth grown in July-September (rainy season). The plant size fitted the pot best without reducing the flower size and number. However, This application was not suitable for those grown in October-January (winter) for it reduced the plant size and flower number. The best application for winter was using paclobutrazol at 10 ppm on 21-day-old plant 4 times.

Key words: *Zinnia angustifolia* Kunth, plant growth retardant, paclobutrazol

INTRODUCTION

Classic zinnia (*Zinnia angustifolia* Kunth) is an annual plant, growing as bedding and pot plant. During the process sometimes it grows out of the container very rapidly and difficult to handle. Therefore, the way to manipulate this condition is using plant growth retardant, which is common practice to make plant more compacts.

Plant growth retardants (PGRs) have been used to manipulate the plant size, shape and overall quality of floricultural crops. In many cases bedding plants (e.g. Zinnia, Chrysanthemum) are treated with PGRs to promote compactness, maintain quality prior to sale and also promote longer-shelf life (Richard, 1996).

Paclobutrazol is one of the plant growth retardants, which suppresses growth through interference of gibberellic acid biosynthesis, a hormone responsible for cell elongation (Dalziel and Lawrence, 1984). Therefore the abilities of

paclobutrazol are to retard plant growth, to induce tolerance to abiotic stress and to increase chlorophyll content. Their duration is usually from 4 to 7 weeks depending on application rate (Davis and Curry, 1991). Paclobutrazol shows to be very effective in reducing the height of a variety of bedding plant (Cox and Keever, 1988). However, it is not effective on every plant but depending upon species, concentration, method, timing, duration, part of plant and application rate (Holcomb and Gohn, 1995).

The objective of this study was to explore possible way to manipulate growth and increase productivity of classic zinnia (*Zinnia angustifolia* Kunth.) as commercial pot plant.

MATERIALS AND METHODS

The experiment was conducted at experimental field, Department of Horticulture, Kasetsart University (Bangkhen Campus) Bangkok

during July 2000 to January 2001. Cultivation was divided into 2 crops, July-September (rainy season) and October-January (winter). Classic zinnia seeds were sown in peat moss media, pinching when it was 21 days old and then transplant into 10 cm pot when they were 42 days old. Combinations of times and concentrations for paclobutrazol applications were arranged to form 22 treatments. Each of 4 concentrations, i.e. 0, 5, 10 and 15 ppm applied at weekly intervals for 4 times starting from 21 days after sowing was followed by each of 4 concentrations, i.e. 0, 20, 25 and 30 ppm applied at weekly intervals for 3 times starting from 49 days after sowing. These combinations (16 treatments) were compared with 3 concentrations (5, 10, & 15 ppm) applied conscentively 7 times throughout the period from 21 to 63 days after sowing. In addition, another 3 treatments were included, i.e. 5, 10 and 15 ppm applied to untreated plant at weekly intervals for 3 times strating from 49 days after sowing. Plant height and width was evaluated every week but number of flower, flower size, number of nodes and internode length was measured on final week (12th week), a most flower was bloom.

RESULTS AND DISCUSSION

The result showed that paclobutrazol affected height, width (Table 1), internode length, number of nodes, number of branches and number of flowers (Oct.-Jan) but did not affect flower size and number of flowers, during July to September (Table 2). Because paclobutrazol inhibited gibberellin synthesis (Dalziel and Lawrence, 1984) resulted in reduction in cell elongation.

Paclobutrazol application at 10 ppm on 21-day-old plants 4 time and changed to 25 ppm 3 time gave the best result for classic zinnia in July-September (rainy season). Considering on concentration, changing paclobutrazol concentrations while the plant was growing up increased their effectiveness (Table 1), this may be because the previous concentration is not enough to regulate rapid growth so it needs a higher concentration to inhibit gibberellin synthesis.

However, this concentration is not suitable for zinnia that was grown in October-January

(winter) because during that season plant size is very small. May be not only effect of paclobutrazol but environment also regulated plant size. Because in winter, annual plant responded to short day that induced reproductive growth and cool temperature also retarded growth rate (Wongkaew, 1992). Therefore, this season the best application method is that the use of paclobutrazol at 10 ppm concentration on 21-day-old plant 4 times, this is enough to manipulate zinnia size to suit for 4 inch pot.

CONCLUSION

Application of paclobutrazol 10 ppm to 21-day-old plant 4 times and changed concentration to 25 ppm 3 times during July-September (rainy season) had strong effect and could control plant size to fit the 4 inch pot without reducing the flower size and number. However, changing concentration was not suitable for the plant that grown in winter. The best application for October-January (winter) was paclobutrazol at 10 ppm concentration on 21-day-old plant 4 times.

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Table1 Effects of paclobutrazol on height and width of classic zinnia during rainy season and winter.

Concentration (ppm)		Height (cm)			Width (cm)		
21-day-old	49-day-old	10 th Week		12 th Week		10 th Week	
4 times	3 times	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.
0	0	29.47 ^{abc}	16.56 ^a	32.13 ^{abc}	21.83 ^a	29.9 ^{abc}	18.43 ^a
5	0	25.43 ^{def}	11.83 ^{bc}	27.78 ^{c-f}	17 ^{bcd}	26.23 ^{de}	15.75 ^{bcd}
5	5	25.83 ^{def}	9.82 ^{de}	30.17 ^{b-e}	14.3 ^{cde}	28 ^{a-d}	14.19 ^{cde}
5	20	23.13 ^{e-l}	8.91 ^{def}	27.83 ^{c-f}	14.17 ^{c-f}	26.77 ^{cde}	12.71 ^{e-h}
5	25	24.27 ^{d-h}	9.08 ^{de}	29.5 ^{b-e}	12 ^{e-f}	25.3 ^{de}	11.93 ^{e-h}
5	30	22.87 ^{f-l}	7.96 ^{efg}	28.33 ^{c-f}	11.77 ^{e-f}	27.9 ^{a-d}	11.85 ^{e-h}
0	5	29.97 ^{ab}	13.87 ^b	34.9 ^a	18.3 ^b	31.13 ^a	18.1 ^{ab}
10	0	24.97 ^{d-g}	11.82 ^{bc}	30.17 ^{b-e}	17.33 ^{bc}	25.5 ^{de}	16.79 ^{abc}
10	10	23.63 ^{e-i}	7.63 ^{efg}	27.57 ^{c-f}	12.67 ^{ef}	24.5 ^{de}	12.51 ^{e-h}
10	20	20.6 ⁱ	8.73 ^{efg}	23.87 ^{fg}	14.46 ^{c-f}	25.07 ^{de}	13.47 ^{d-g}
10	25	20.5 ⁱ	8.17 ^{efg}	23.03 ^g	12.4 ^{e-f}	24.6 ^{de}	12.42 ^{e-h}
10	30	21.13 ^{hi}	8.13 ^{efg}	27.77 ^{c-f}	13.27 ^{def}	25.9 ^{de}	11.19 ^{fgh}
0	10	31 ^a	13.48 ^b	33.47 ^{ab}	17.53 ^{bc}	30.57 ^{ab}	17.23 ^{ab}
15	0	25.43 ^{def}	8.93 ^{def}	28.5 ^{c-f}	14.47 ^{b-e}	26.9 ^{cde}	13.67 ^{d-g}
15	15	23.87 ^{e-l}	8.63 ^{efg}	27.77 ^{c-g}	17.64 ^{b-g}	26.17 ^{de}	13.91 ^{def}
15	20	21.59 ^{ghi}	8.29 ^{efg}	27.4 ^{def}	11.5 ^{ef}	27.2 ^{b-e}	12.52 ^{e-h}
15	25	21.47 ^{hi}	6.65 ^g	28.43 ^{c-f}	10.29 ^f	24 ^e	10.43 ^h
15	30	21.67 ^{ghi}	6.78 ^{fg}	25.83 ^{efg}	11.5 ^{ef}	26 ^{de}	11.11 ^{gh}
0	15	26.07 ^{def}	12.37 ^{bc}	28.93 ^{b-e}	16.8 ^{bcd}	26.2 ^{de}	14.27 ^{cde}
0	20	27.37 ^{bcd}	12.47 ^{bc}	30.97 ^{a-d}	15.3 ^{b-e}	27.57 ^{b-e}	14.57 ^{cde}
0	25	26.37 ^{cde}	10.97 ^{cd}	28.93 ^{b-e}	14.67 ^{b-e}	26.8 ^{cde}	12.85 ^{e-h}
0	30	27.57 ^{bcd}	13.12 ^b	30.93 ^{a-d}	15.23 ^{b-e}	26.03 ^{de}	15.67 ^{bcd}
F-test		**	**	**	**	**	**
C.V.(%)	7.3	11.2	8.3	13.6	6.9	10.3	5.9
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Mean within each column followed by the same letter are not significantly different based on Duncan' New Multiple Rang Test at 99%

** = P significance at 0.01

Table 2 Effects of paclobutrazol on internode length, number of nodes, number of branches, number of flowers and flower size of classic zinnia during rainy season and winter.

Concentration (ppm)		Internode length (cm)		Number of nodes (node)		Number of branches		Number of flowers		Flower size (cm)	
21-day-old	49-day-old	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.	Jul.-Sep.	Oct.-Jan.
4 times	3 times										
0	0	2.61 ^a	2.44 ^a	5.27 ^{b-e}	4.33 ^{ab}	13.8 ^{ab}	9.13 ^a	57.00	70.6 ^a	2.64	2.64
5	0	2.06 ^{a-d}	2.01 ^{ab}	5.63 ^{a-e}	4 ^{b-e}	12.4 ^{a-e}	7 ^{b-g}	48.47	43.87 ^{b-e}	2.86	2.57
5	5	1.89 ^{a-d}	1.87 ^{bc}	4.92 ^e	4.07 ^{a-e}	11.53 ^{be}	7.27 ^{b-g}	49.13	46.73 ^{bcd}	2.68	2.53
5	20	1.96 ^{a-d}	1.39 ^{c-f}	5.93 ^{abc}	4.27 ^{abc}	13.4 ^{abc}	7.73 ^{a-d}	71.40	53.77 ^b	2.66	2.62
5	25	1.91 ^{a-d}	1.18 ^{ef}	5.31 ^{b-e}	4.27 ^{abc}	11.93 ^{a-e}	6.67 ^{b-g}	53.60	31.07 ^e	2.54	2.66
5	30	1.74 ^{bcd}	1.34 ^{c-f}	4.97 ^{de}	3.73 ^{de}	11.13 ^{cde}	7.6 ^{b-e}	53.87	47.33 ^{bcd}	2.84	2.61
0	5	2.64 ^a	1.89 ^{bc}	5.27 ^{b-e}	3.72 ^{de}	10.93 ^{de}	6.8 ^{b-g}	59.53	35.47 ^{de}	2.64	2.49
10	0	2.3 ^{ab}	1.75 ^{b-e}	5.3 ^{be}	4.33 ^{ab}	11.87 ^{a-e}	7.87 ^{abc}	49.60	53.13 ^b	2.45	2.51
10	10	2.06 ^{a-d}	1.67 ^{b-f}	5.17 ^{cde}	3.73 ^{de}	11.8 ^{a-e}	6 ^{efg}	52.27	36.87 ^{cde}	2.52	2.38
10	20	2.42 ^{ab}	1.73 ^{b-f}	6.27 ^a	4.47 ^{ab}	12.67 ^{a-e}	7.87 ^{abc}	58.20	51.73 ^{bc}	2.76	2.57
10	25	1.32 ^d	1.53 ^{b-f}	5.37 ^{b-e}	3.98 ^{b-e}	11.6 ^{a-e}	7.07 ^{b-g}	50.87	47.13 ^{bcd}	2.59	2.60
10	30	1.38 ^{cd}	1.49 ^{b-f}	5.53 ^{a-e}	3.6 ^{ef}	11.8 ^{a-e}	6.4 ^{c-g}	49.60	38.4 ^{cde}	2.58	2.45
0	10	1.98 ^{a-d}	1.23 ^{ef}	5.84 ^{a-d}	3.67 ^{de}	12.33 ^{a-e}	6.2 ^{d-g}	65.53	36.93 ^{cde}	2.63	2.20
15	0	2.22 ^{abc}	1.83 ^{bcd}	5.9 ^{abc}	4.53 ^a	13.87 ^a	7.13 ^{b-g}	50.27	37.8 ^{cde}	2.66	2.56
15	15	1.7 ^{bcd}	1.97 ^{ab}	5.07 ^{cde}	3.65 ^{de}	12.13 ^{a-e}	6.83 ^{b-g}	50.33	37.13 ^{cde}	2.73	2.59
15	20	2.05 ^{a-d}	1.57 ^{b-f}	4.83 ^e	3.8 ^{de}	10.4 ^e	6.13 ^{d-g}	46.07	46.33 ^{bcd}	2.72	2.57
15	25	2.26 ^{ab}	1.23 ^{ef}	5.23 ^{b-e}	3.18 ^f	12.6 ^{a-e}	5.77 ^g	45.40	48 ^{bcd}	2.54	2.50
15	30	2.38 ^{ab}	1.38 ^{c-f}	5.3 ^{b-e}	3.7 ^{de}	10.72 ^{de}	5.83 ^{fg}	50.20	31.07 ^e	2.67	2.38
0	15	1.85 ^{a-d}	1.17 ^{ef}	5.23 ^{be}	4.13 ^{a-d}	11.13 ^{cde}	6.07 ^{efg}	44.80	29.67 ^e	2.56	2.49
0	20	2.26 ^{ab}	1.16 ^f	6.1 ^{ab}	4.4 ^{ab}	12.93 ^{a-d}	7.47 ^{b-f}	65.13	43.8 ^{b-e}	2.72	2.52
0	25	2.05 ^{a-d}	1.96 ^{def}	5.87 ^{a-d}	4.33 ^{ab}	12.33 ^{a-e}	6.93 ^{b-g}	63.60	34.87 ^{de}	2.67	2.37
0	30	2.31 ^{ab}	1.38 ^{c-f}	5.47 ^{a-e}	4.4 ^{ab}	11.67 ^{a-e}	8.07 ^{ab}	54.60	55.07 ^b	2.56	2.53
F-test		*	**	*	**	*	**	ns	**	ns	ns
C.V.(%)		21.2	18.8	8.5	10.5	9.6	11.9	19.6	17.5	5.5	5.7

Mean within each column followed by the same letter are not significantly different based on Duncan' New Multiple Rang Test at 99%

Ns = Not significant

*= P significance at 0.05

** = P significance at 0.01