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Chemical Growth Retardants for Height Control of Pot Asters

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Asters (*Aster novi-belgii* L.) are hardy perennials that can reach ≈140 cm tall (Bailey and Bailey, 1976) and bloom naturally in the late summer and fall. For greenhouse-produced pot asters, plants receive long days for 3 to 4 weeks after potting to promote vegetative development and increase plant size. During the vegetative phase, the plants may become elongated and disproportional to pot size, making them less attractive to the consumer. The only recommendation available to growers to control plant height is to apply several foliar sprays of butanedioic acid mono (2,2-dimethylhydrazide) (daminozide) at 1000 to 5000 mg·liter^{-1} (Ball, 1991; Luczai, 1992; McAvoy, 1993; Yoder, 1991). To our knowledge, there are no published reports on using (+)-(R*,R*)-ß([4-chlorophenyl]methyl)-α-(1,1-dimethylethyl)-1*H*-1,2,4-triazole-1-ethanol (paclobutrazol) or (E)-1-(p-chlorphenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl-1-penten-3-ol) (uniconazole). Therefore, this study was conducted to compare the effectiveness of the plant growth retardants (PGR) paclobutrazol and uniconazole to daminozide on development of pot asters.

Rooted cuttings of 'Butterfly Blue' and 'Purple Monarch' asters were planted into 0.6-liter square pots on 10 Mar. 1993. The root medium contained 1 soil : 2 sphagnum peat : 2 perlite (by volume) amended with (per cubic meter of mix) 890 g $Ca(H_2PO_4)_2$, 593 g KNO_3, 593 g $MgSO_4 \cdot 7H_2O$, 4.75 kg ground limestone, and 74 g Peter's fritted trace elements no. 555 (Scott's, Marysville, Ohio). Plants were fertilized at each watering with N and K, each at 200 mg·liter^{-1}, and P at 46 mg·liter^{-1}. Greenhouse day/night set points were 24/18C. Plants were pinched on 24 Mar., leaving four to six nodes. On 2 Apr., 12 PGR treatments (in mg·liter^{-1}) were applied as foliar sprays using 204 ml·m^{-2}: 5000 daminozide; 10, 20, 40, 80, and 160 paclobutrazol; 5, 10, 20, 40, 80, and 160 uniconazole; plus a nontreated control. A completely randomized design of five single-plant replications was used. The plants were grown under long days until 14 Apr., when plants were subjected to 16-h nights under black cloth to induce flowering. When the first inflorescence opened, plant diameter (measured at the widest dimension, turned 90°, then averaged), height (pot rim to the top of the plant), and days from potting to flowering were recorded. Data were tested using analysis of variance by general linear model procedures (SAS Institute, Cary, N.C.). Significantly different means were separated by least significant differences at $P \leq 0.05$.

Foliar applications of daminozide at 5000 mg·liter^{-1} had the greatest effect on plant height for both cultivars, with plant height 29% and 24% shorter, respectively, than the nontreated plants (Table 1). With paclobutrazol at 160 mg·liter^{-1}, plants also were 22% and 14% shorter than nontreated plants for 'Butterfly Blue' and 'Purple Monarch', respectively. The effectiveness of uniconazole varied by cultivar, with a rate of ≥10 mg·liter^{-1} controlling plant height of 'Purple Monarch' by ≥10%. Uniconazole did not significantly affect 'Butterfly Blue' plant height until the rate was ≥40 mg·liter^{-1}.

Plant diameter was affected by PGR treatment. Plants treated with (in mg·liter^{-1}) 5000 daminozide, 160 paclobutrazol, and ≥40 uniconazole were significantly smaller in diameter, with a reduction of ≥12% compared to nontreated plants (Table 1).

The average number of days from potting to flowering was 63 for nontreated plants of both cultivars (data not shown). Flowering was delayed by 5 days with daminozide at 5000 mg·liter^{-1} and by 2 days with uniconazole at 160 mg·liter^{-1} compared to the nontreated plants.

The height control we obtained with daminozide agrees with results from other researchers (Ball, 1991; Luczai, 1992; McAvoy, 1993; Yoder, 1991), although other researchers made no direct comparisons among PGRs on final plant height. Height control was similar for 'Purple Monarch' with (in mg·liter^{-1}) 80 and 160 uniconazole or 5000 daminozide and for 'Butterfly Blue' with 160 paclobutrazol or 5000 daminozide. Growers will have to account for cultivar responsiveness and compare the cost of PGRs to determine the most effective treatment.

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Table 1. Effect of chemical plant growth retardant (PGR) spray applications on pot asters.

PGR and concn (mg·liter^{-1})	Cultivar			
	Butterfly Blue		Purple Monarch	
	Ht (cm)[z]	Diam (cm)[z]	Ht (cm)[z]	Diam (cm)[z]
Nontreated	20.5	26.4	25.3	20.1
Daminozide				
5000	14.6	20.3	19.2	17.0
Paclobutrazol				
10	19.8	23.5	25.4	19.5
20	19.8	28.4	24.8	19.4
40	17.8	24.8	24.8	18.2
80	18.6	26.3	24.1	19.0
160	16.0	23.9	21.7	17.1
Significance	L^{**}, Q^{ns}, C^{ns}	L^{ns}, Q^{ns}, C^{ns}	L^{**}, Q^{ns}, C^{ns}	L^{ns}, Q^{ns}, C^{ns}
Uniconazole				
5	18.8	25.4	24.6	20.0
10	19.6	24.8	22.7	19.6
20	20.2	26.4	21.7	16.8
40	17.3	24.1	20.6	16.5
80	17.5	22.7	19.5	15.6
160	17.4	22.0	18.6	15.2
Significance[y]	L^{*}, Q^{ns}, C^{ns}	L^{*}, Q^{ns}, C^{ns}	L^{*}, Q^{ns}, C^{ns}	L^{**}, Q^{ns}, C^{ns}
$LSD_{0.05}$	2.6	3.6	2.2	2.3

[z]Plant height and diameter were significant at $P \leq 0.01$ for each cultivar.

[ns,*,**]Nonsignificant or significant single-degree-of-freedom test for each cultivar and PGR treatment (paclobutrazol and uniconazole) at $P \leq 0.05$ or 0.01, respectively, and were linear (L), quadratic (Q), or cubic (C).

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