Chemical Growth Retardant Application to Tuberous-rooted Dahlias

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In adapting tuberous-rooted dahlia (*Dahlia variabilis* Willd.) plants for greenhouse container production, they are generally disproportionately large relative to the container, making them less attractive to consumers. DeHertogh and Blakely (1976) recommended applying soil drenches of α -cyclopropyl- α -(4-methoxyphenyl)-5-pyrimidinemethanol (ancymidol) at 0.25 to 2.0 mg a.i./pot, 10 to 14 days after potting the tubers for height control. Soil drenches of chlormequat (270 and 540 mg a.i.) and foliar sprays of butanedioic acid mono(2,2-dimethylhydrazide) (daminozide) (2500 and 5000 mg-liter⁻¹) were not effective in controlling dahlia height (DeHertogh and Blakely, 1976). Foliar sprays of chlormequat at 1000, 2000, and 3000 mg-liter⁻¹ had the greatest effect on plant height for dahlias grown in the field for cut flowers, with a final height of 66% of the control (Gowda et al., 1991). Foliar sprays (10 to 80 mg-liter⁻¹) or drenches (rates up to 2 mg) of (+)-(R*,R*)- β [(4-chlorophenyl)methyl]- α -(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol (paclobutrazol) were not effective in controlling plant height of seeded dahlias (Shanks, 1980). Currently, to our knowledge, no information is available on the effectiveness of paclobutrazol or (E)-1-(p-chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol (uniconazole) on tuberous-rooted dahlias. This study was conducted to compare the effectiveness of ancymidol, paclobutrazol, and uniconazole as a chemical height control for tuberous-rooted dahlias.

Dormant tubers of 'Golden Emblem' and 'Red Pigmy' dahlias were potted into 1.5-liter round plastic pots on 23 Mar. 1994. The root medium contained 1 soil : 2 sphagnum peat : 2 perlite (by volume) and was amended with (per cubic meter of mix) 890 g Ca(H₂PO₄)₂, 593 g KNO₃, 593 g MgSO₄·7H₂O, 4.75 kg ground limestone, and 74 g Peter's fritted trace elements no. 555 (Scotts, Marysville, Ohio). Plants

were fertilized at each watering (mg-liter⁻¹) with 201 N, 46 P, and 200 K. Greenhouse day/night set points were 24/18C. The plants were grown under natural daylength. Eight plant growth retardant (PGR) media drench treatments (mg a.i./pot) were applied 11 days after potting at 118 ml per pot: ancymidol, 1.5 and 2.0; paclobutrazol, 0.24, 0.47, 0.95, and 1.9; uniconazole, 0.24 and 0.47; plus a nontreated control. A completely randomized design of 10 single-plant replications was used. When the first inflorescence opened, the number of days from potting until flowering was recorded. When 90% of the plants had an open inflorescence (16 May for 'Red Pigmy' and 2 June for 'Golden Emblem'), leaf canopy height measured from the pot rim to the top of the foliage, inflorescence height above the foli-

age, and plant diameter (measured at the widest dimension and turned 90°, then averaged) were recorded for all plants. For those plants not in flower, the above measurements were recorded when the first inflorescence opened. Data were tested by analysis of variance by general linear model procedures (SAS Inst., 1990). Means were separated by least significant differences at $P \leq 0.05$.

The cultivar $\times$ treatment interaction for total plant height, leaf canopy height, and inflorescence height was significant. Ancymidol drenches at 1.5 and 2.0 mg had the greatest effect on total plant height for 'Red Pigmy' and 'Golden Emblem', with a final height 45% less than the control (Fig. 1). Total plant height of 'Red Pigmy' with uniconazole at 0.24 and 0.47 mg and of 'Golden Emblem' at 0.47 mg was 20% less than that of the control. Paclobutrazol had no significant effect on total plant height for 'Red Pigmy', but all the rates of paclobutrazol resulted in significantly shorter total height of 'Golden Emblem'.

The leaf canopy height was least with ancymidol at 1.5 and 2.0 mg. 'Red Pigmy' and 'Golden Emblem' plants were 27% and 37% shorter, respectively, than the control (Fig. 1). Leaf canopy height was also 20% shorter for 'Red Pigmy' plants with uniconazole at 0.24 and 0.47 mg. Paclobutrazol at 0.47, 0.95, and 1.9 mg produced a significantly shorter leaf canopy height for 'Golden Emblem', but it had no effect on 'Red Pigmy'.

Fig. 1. Effect of plant growth retardants (PGR) (milligrams/pot) on canopy height, inflorescence height, and total plant height of (top) 'Red Pigmy' and (bottom) 'Golden Emblem' pot dahlias. Leaf canopy height, inflorescence height, and total height significant at $P \leq 0.001$, 0.056, or 0.001, respectively, for the cultivar $\times$ treatment interaction. LSD ($\alpha \leq 0.05$) for leaf canopy height, inflorescence height, and total height, 4.0, 5.6, or 7.6, respectively, for the cultivar $\times$ PGR interaction.

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Ancymidol at 1.5 and 2.0 mg significantly affected ($P \leq 0.056$) inflorescence height for 'Red Pigmy' and 'Golden Emblem', with a reduction of 75% and 55%, respectively, when compared to the control (Fig. 1). The total height control achieved by the use of ancymidol was primarily due to a reduction of inflorescence height, rather than leaf canopy height. The inflorescence height of 'Red Pigmy' with uniconazole at 0.24 mg was 34% shorter than that of the control, while 'Golden Emblem' inflorescence height was 20% shorter at 0.47 mg. All paclobutrazol rates produced significantly shorter inflorescence height for 'Golden Emblem', but had no effect on 'Red Pigmy'.

Plant diameter of both cultivars was affected similarly by the PGRs. Ancymidol-treated plants had a significantly smaller plant diameter than with the use of either paclobutrazol or uniconazole, with a reduction of at least 19% when compared to the control (Table 1). The effect of the two ancymidol treatments was similar.

The effects of the PGR treatments on the number of days from potting to flowering were similar for both cultivars. Ancymidol at 1.5 and 2.0 mg delayed flowering by 5 days when compared to the control (Table 1). The number of days from potting to bloom was 50 days (nontreated control) for 'Red Pigmy', while 'Golden Emblem' required 61 days.

'Golden Emblem' was the more vigorous cultivar, with a height of 90.2 cm for the nontreated control, and both ancymidol rates produced acceptable-sized potted plants. While the degree of reduction in 'Golden Emblem'

Table 1. Effectiveness of plant growth retardant (PGR) on plant diameter and days from potting until flowering for 'Red Pigmy' and 'Golden Emblem' dahlias grown as pot plants.

PGR treatment	Rate (mg a.i./pot)	Plant diam (cm)	Days to flowering
None	---	55.0	55.6
Paclobutrazol	0.24	55.2	57.6
	0.47	55.7	56.7
	0.95	51.6	58.6
	1.9	53.6	56.4
Ancymidol	1.5	44.7	60.6
	2.0	42.1	60.8
	0.24	51.4	58.0
Uniconazole	0.47	51.5	56.2
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Significance			
LSD ($\alpha \leq 0.05$)		3.1	2.6

, *Significant at $P \leq 0.01$ or 0.001, respectively, for the treatment interaction.

total plant height was statistically significant with paclobutrazol and uniconazole, it was insufficient to produce a plant suitable for potted-dahlia production. 'Red Pigmy' is a less vigorous cultivar, with the nontreated control plants having been 40.9 cm high. Both rates of uniconazole produced marketable plants. Paclobutrazol at the rates used did not provide adequate height control for 'Red Pigmy', and ancymidol-treated plants were too short. Lower ancymidol rates than those used in this study may be more appropriate for less vigorous cultivars, such as 'Red Pigmy'.

The degree of height control achieved with ancymidol in this study agrees with earlier work by DeHertogh and Blakely (1976). Ancymidol at 1.5 and 2.0 mg for 'Golden Emblem' and uniconazole at 0.24 and 0.47 mg for 'Red Pigmy' were the most effective in

controlling plant height and produced marketable-sized plants, with only a minimal delay in flowering.

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