Inhibiting Growth of Flowering Crops with Ancymidol and Paclobutrazol in Subirrigation Water

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Abstract. Contamination of recirculated subirrigation water with growth retardants poses a potential problem for growers. Eight concentrations of ancymidol or paclobutrazol ranging from 0 to 100 µg·L⁻¹ (0 to 1000 µg·L⁻¹ for petunia) were supplied constantly in subirrigation water to potted plants to identify critical levels at which plant growth is affected. Concentrations of ancymidol resulting in 20% reduction in plant size relative to untreated controls were 3, 10, 98, 80, and 58 µg·L⁻¹ for Begonia ×semperflorens-cultorum Hort. ‘Gin’, chrysanthemum (Dendranthema ×grandiflora) ebb and flow, growth regulator, growth retardant, Impatiens walleriana, Petunia ×hybrida, Salvia splendens. Additional index words: Begonia ×semperflorens-cultorum, chrysanthemum, Dendranthema ×grandiflora ebb and flow, growth regulator, growth retardant, Impatiens walleriana, Petunia ×hybrida, Salvia splendens.

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ancymidol to be more effective on chrysanthemum than paclobutrazol at the same drench concentration. Wilfret (1987) found that up to 5 to 10× higher drench concentration of paclobutrazol was required to give the same effect as ancymidol on Easter lily (*Lilium longiflorum* L.). At the same drench concentration, paclobutrazol was much more effective than ancymidol (63% vs. 15% reduction) in controlling height of *Ficus benjamina* L. (Barrett and Nell, 1983).

The five plants tested varied considerably in their sensitivity to ancymidol and paclobutrazol (Table 1). When placed in decreasing order of sensitivity to ancymidol, the ranking was begonia > chrysanthemum > salvia > petunia > impatiens. The concentration of ancymidol resulting in a 20% reduction in plant size ranged from 3 µg·L⁻¹ for begonia to 98 µg·L⁻¹ for impatiens. For paclobutrazol, the relative order was begonia > impatiens > chrysanthemum > petunia (salvia unknown). The concentration of paclobutrazol resulting in a 20% plant size reduction ranged from 5 µg·L⁻¹ for begonia to >100 µg·L⁻¹ for salvia.

Note that begonia and chrysanthemum data were taken 8 and 6 weeks after planting, respectively, while data for impatiens, salvia, and petunia were taken 4 to 5 weeks after planting. The apparent sensitivity of the latter crops to both chemicals might have been greater had they been grown for a longer period of time, as nontreated plants could grow larger while treated plants could continue to be affected. Nonetheless, nontreated plants of all five crops were large and of greater than marketable size, so that the relative response is a general comparison.

These results illustrate that ancymidol and paclobutrazol are active at low concentrations in subirrigation water. Contamination of the water is possible from spray residues on bench surfaces, which can affect growth of nontarget crops irrigated with same water (Al-Badawy et al., 1995). Growers who suspect contamination of subirrigation water with ancymidol or paclobutrazol can use a broccoli (*Brassica oleracae* var. *botrytis* L.) seedling bioassay test (Million et al., 1996) to estimate growth regulator concentrations based upon the values in Table 1. In commercial operations effects of contaminated water could be moderated by using the water on crops tolerant of the chemical. Also, sensitive crops could be grown in a bark-based medium, which reduces the activity of ancymidol (Tschabold et al., 1975) and paclobutrazol (Million et al., 1998).

These results also indicate that application of growth regulators in subirrigation water may be a labor-saving method of application in commercial production. However, the differences in sensitivity of the crops tested demonstrates that this method of application will be difficult except under monoculture situations.

**Literature Cited**

Adriansen, E. 1989. Growth and flowering in pot plants soaked with plant growth regulator solutions in ebb and flood benches. Acta Hort. 251:319–327.
Table 1. Concentrations of ancymidol and paclobutrazol (µ·L–1) in subirrigation water required for 10% and 20% reduction in plant growth.

| Species          | Ancymidol | Paclobutrazol | Reduction in plant size |
|------------------|-----------|---------------|-------------------------|
|                  | 10%       | 20%           | 10%                     | 20%                     |
| Begonia          | 1         | 3             | 2                       | 5                       |
| Chrysanthemum    | 4         | 10            | 10                      | 24                      |
| Impatiens        | 29        | 98            | 7                       | 17                      |
| Petunia          | 30        | 80            | 130                     | 390                     |
| Salvia           | 21        | 58            | >100                    | >100                    |

Values calculated from equations in Figs. 1–5.
Size was calculated as the (average width + height)/2.
>100 indicates that the reduction was not achieved at the highest concentration tested.

Al-Badawy, A.A., J.E. Barrett, and T.A. Nell. 1995. Potential for paclobutrazol residue problems in greenhouse recirculated irrigation systems. Proc. Plant Growth Reg. Soc. Amer. 22:377–381.
Barrett, J.E., C.A. Bartuska, and T.A. Nell. 1987. Efficacy of ancymidol, daminozide, flurprimidol, paclobutrazol, and XE-1019 when followed by irrigation. HortScience 22:1287–1289.
Barrett, J.E. and T.A. Nell. 1983. Ficus benjamina response to growth retardants. Proc. Florida State Hort. Soc. 96:264–265.
Menhenett, R. 1984. Comparison of a new triazole retardant, paclobutrazol (PP333), with ancymidol, chlorphonium chloride, daminozide, and piproctanyl bromide, on stem extension and inflorescence development in Chrysanthemum morifolium Ramat. Scientia Hort. 24:349–358.
Million, J.B., J.E. Barrett, and T.A. Nell. 1996. Procedure to estimate concentrations of ancymidol and paclobutrazol in subirrigation water. Greenhouse Prod. News. Nov.
Million, J.B., J.E. Barrett, T.A. Nell, and D.G. Clark. 1998. Influence of media components on efficacy of paclobutrazol in inhibiting growth of broccoli and petunia. HortScience 33:852–856.
SAS Institute. 1987. SAS/STAT guide for personal computers. vers. 6. 675–712. SAS Inst., Cary, N.C.
Tagliavini, M. and N.E. Looney. 1991. Response of peach seedlings to root-zone temperature and root-applied growth regulators. HortScience 26:870–872.
Tschabold, E.E., W.C. Meredith, L.R. Guse, and E.V. Krumkalns. 1975. Ancymidol performance as altered by potting media composition. J. Amer. Soc. Hort. Sci. 100:142–144.
Wilfret, G.J. 1987. Growth retardation of Easter lilies grown in containers. Proc. Florida State Hort. Soc. 100:379–382.