Height Control of Potted Aurelian and Tiger Lilies

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Abstract

Height control of potted *Lilium lancifolium* (Tiger lily) and *L. × aurelianense* (Aurelian lily) plants would improve their marketability in the garden center and extend their market season. Bulbs (16-18 cm) were treated with Concise (uniconazole) or Piccolo (paclobutrazol). Bulbs were dipped for one minute in a 0, 2, 4, 8, or 16 mg/L Concise solution or for 15 minutes in a 0, 5, 10, 20, or 40 mg/L Piccolo solution. Drenches were applied at 300 ml per 3.4-L pot when shoots had reached ~5 cm in height. Drench rates were 0, 1, 2, 4 or 8 mg/L Concise or 0, 5, 10, 20 or 40 mg/L Piccolo. Concise dips were more effective in reducing Tiger lily plant height than drenches, with dips resulting in a 52% height reduction at six weeks after potting (WAP). Final plant height at 9 WAP was reduced 37% by the 4 mg/L dip rate which was comparable to the growth reduction of the 8 mg/L drench application. In contrast, Piccolo drenches were more effective than dips in controlling Tiger lily plant height. Piccolo applied as 10 mg/L drenches resulted in a 23% reduction in plant height at 6 WAP while dip rates at 20 or 40 mg/L resulted in similar height control. These plants were of acceptable size for marketing as potted plants. Aurelian lilies were less responsive to Concise. The 16 mg/L dip reduced plant height 60% at 6 WAP, resulting in a 46% height reduction at flowering (11 WAP). Concise dip or drench rates between 4 and 8 mg/L resulted in moderate (~30%) height control at 6 WAP that did not persist through flowering. Piccolo had no significant effect on height of Aurelian lily. The treatments did not affect time to flowering, flower number or width of the first open flower in either crop.

INTRODUCTION

Production of lilies for the home landscape market continues to increase in the United States (Pilon, 2006). There also is interest among breeders and marketers of potted crops to produce more potted lilies, other than Easter lilies, for holiday markets (Wells, 2010). While research on production practices and the use of plant growth regulators (PGRs) is extensive on Asiatic and Oriental lilies (Miller et al., 2005; Krug and Whipker, 2004), less is known about height control during production of other landscape lilies. Spray applications of PGRs require multiple applications to achieve sufficient height control of most lilies (Pilon, 2006). Barnes et al. (2010) reported flurprimidol applied as a bulb dip effective in reducing plant height of *Lilium lancifolium* ‘Orange Tiger’. Height control of potted *L. lancifolium* (Tiger lily) and *L. × aurelianense* (Aurelian lily) plants would improve their marketability in the garden center and extend their market season.

Our objective was to evaluate the PGRs, Concise (uniconazole) and Piccolo (paclobutrazol), applied as dips (bulb soaks) or drenches on growth control of containerized ‘Red Twinkle’ Tiger lily and ‘Pink Perfection’ Aurelian lily.

MATERIALS AND METHODS

Commercial bulbs (16/18 cm) were purchased from K. van Bourgondien & Sons, Inc. (Virginia Beach, Virginia, USA) on 3 March 2010. Concise (uniconazole) or Piccolo (paclobutrazol) (both Fine Americas, Inc., Walnut Creek, California, USA) was applied as a bulb dip prior to planting or as a drench when plants were about 5 cm tall. Bulbs were planted in 3.4-L plastic pots filled with a peat-lite medium (Fafard 52, Conrad
Fafard, Inc., Agawam Mass., USA). Plants were watered as necessary to prevent stress and fertilized with each irrigation with 200 mg/L N using 20-10-20. Dips were applied by soaking unwashed bulbs in a solution of Concise at 0, 2, 4, 8 or 12 mg/L for 1 min or Piccolo at 0, 5, 10, 20, or 40 for 15 min. Bulbs were allowed to drain for 1 h, then returned to cold storage overnight. All bulbs were potted 11 March 2010 and placed in the greenhouse. Drenches were applied as 300 ml of PGR solution poured evenly over the surface of moist medium when the plants had reached a height of about 5 cm. Drench rates were: Concise at 0, 1, 2, 4, or 8 mg/L or Piccolo at 0, 5, 10, 20, or 40 mg/L. Drenches were applied to the Tiger lilies on 23 March and to Aurelian lilies on 26 March.

Data collected included plant height, date of flowering and flower width when first flower was fully expanded. Each species and PGR was set up as an individual experiment with plants arranged in a completely randomized design with five single plant replications. Data were subjected to PROC-GLM and PROC REG within a species, chemical and application method.

RESULTS

**Tiger Lily**

Tiger lily plant height was reduced by both growth regulators in a quadratic manner with increasing rates. However, time to flowering (56 days), flower number (4.9 open flowers at 9 weeks after potting (WAP)) and width of the first open flower (14.9 cm) were not affected by the PGR treatments.

Plant height of Tiger lily was reduced by Concise dips and drenches in a quadratic manner at both 6 and 9 WAP (Fig. 1). Concise dips were more effective than drenches, with Concise dips resulting a 52% height reduction at 6 WAP. Final plant height at 9 WAP was reduced 37% by the 4 mg/L dip rate. Higher dip rates resulted in excessive height reductions. Note: dip rates were 0, 2, 4, 8, and 16 mg/L while drench rates were lower, 0, 1, 2, 4, or 8 mg/L (300 ml/pot). The 8 mg/L drench rate reduced final plant height by 38% at 9 WAP; comparable to the plant response to the 4 mg/L bulb dip. Concise dip or drench rates between 4 and 8 mg/L resulted in moderate height control.

Plant height of Tiger lily was reduced by Piccolo dips and drenches in a linear or quadratic manner at both 6 and 9 WAP (Fig. 2). In contrast to the response to Concise, Piccolo drenches were more effective than dips in controlling plant growth. Piccolo applied as a 10 mg/L drench resulted in a 23% reduction in plant height at 6 WAP while dip rates at 20 or 40 mg/L resulted in similar height control. Note: both drench and dip rates were 0, 5, 10, 20 or 40 mg/L. Final plant height at flowering was reduced 31% with 20 mg/L drenches (9 WAP) while 40 mg/L dips reduced final plant height by only 16%.

**Aurelian Lily**

Aurelian lily showed a moderate growth response to Concise but was not responsive to Piccolo. Time to flowering (71 days), flower number (1.4 open flowers at 11 WAP) and width of the first open flower (14.8 cm) were not affected by the PGR treatments.

The Aurelian lily plant height showed a quadratic response to increasing rates of Concise at both 6 and 11 WAP, with a 60% reduction in plant height at 6 WAP with the highest dip rate (Fig. 3). Both 4 and 8 mg/L Concise drenches reduced plant height about 30% at 6 WAP but these reductions did not persist through flowering (11 WAP). Note: dip rates were 0, 2, 4, 8, and 16 mg/L while drench rates were 0, 1, 2, 4, or 8 mg/L (300 ml/pot). Maximum growth control was achieved with the bulb dip at 16 mg/L which reduced final plant height 46% at 11 WAP. Piccolo had no significant effect on Aurelian lily plant growth (data not presented).

DISCUSSION

Based on the cultivars selected, Tiger lilies are much more responsive to Concise and Piccolo than are Aurelian lilies. The optimum PGR rates for Tiger lily were 4 mg/L
Concise applied as a bulb dip or 20 mg/L Piccolo applied as a drench. Tiger lily plants would be amenable to marketing as a potted crop. According to Miller et al. (2005), the industry preferred height for potted lilies is about 55 cm. Bulb dips or drenches with Concise at 4 mg/L manages plant growth to meet this standard. Piccolo drenches at 20 mg/L also produced plants with a final plant height below 55 cm. Flurprimidol at 10 to 20 mg/L applied to Tiger lily as a bulb dip for 10 min also produced plants with a final height of less than 55 cm (Barnes et al., 2010).

Aurelian lily was not responsive to Piccolo at the rates tested but the best Concise treatment in our test was between 8 and 16 mg/L applied as a bulb dip. This rate did not result in plants less than 55 cm in height. Additional work with higher rates is necessary to establish a PGR recommendation to meet a potted crop standard. However, even moderate growth regulation of these crops improves the appearance of the plants in the pot and improves plant handling and management in the garden center.

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Literature Cited
Fig. 1. Plant height of ‘Red Twinkle’ Tiger Lily was reduced by Concise (uniconazole) dips and drenches in a quadratic manner at both 6 and 9 weeks after potting (WAP). Note: dip rates were 0, 2, 4, 8, and 16 mg/L (1X=2 mg/L) while drench rates were 0, 1, 2, 4, or 8 mg/L (1X=1 mg/L; applied at 300 ml/pot).

Regression equations:
- Drench (9 WAP): Height = 72.01 - 4.85(rate) + 0.16(rate*rate), r² = 0.58.
- Dip (9 WAP): Height = 72.85 - 7.26(rate) + 0.31(rate*rate), r² = 0.82.
- Drench (6 WAP): Height = 57.22 - 4.16(rate) + 0.16(rate*rate), r² = 0.53.
- Dip (6 WAP): Height = 56.84 - 6.47(rate) + 0.28(rate*rate), r² = 0.87.
Fig. 2. Plant height of ‘Red Twinkle’ Tiger Lily was reduced by Piccolo (paclobutrazol) dips and drenches at both 6 and 9 weeks after potting (WAP). Note: both drench and dip rates were 0, 5, 10, 20 or 40 mg/L (drenches applied at 300 ml per pot).

Regression equations:
Dip (9 WAP): Height = 71.30 - 0.32(rate), $r^2 = 0.29$.
Drench (9 WAP): Height = 76.19 - 1.57(rate) + 0.02(rate*rate), $r^2 = 0.79$.
Dip (6 WAP): Height = 57.04 - 0.44(rate) + 0.002(rate*rate), $r^2 = 0.41$.
Drench (6 WAP): Height = 61.98 - 1.63(rate) + 0.02(rate*rate), $r^2 = 0.74$. 
Fig. 3. Plant height of ‘Pink Perfection’ Aurelian Lily was reduced by Concise (uniconazole) dips and drenches at six and nine weeks after potting (WAP). Note: dip rates were 0, 2, 4, 8, and 16 mg/L (1X=2 mg/L) while drench rates were 0, 1, 2, 4, or 8 mg/L (1X=1 mg/L; applied at 300 ml/pot).

Regression equations:
Dip (11 WAP): Height = 118.91 - 0.82(rate) - 0.15(rate*rate), r² = 0.51.
Drench (11 WAP): Height = 85.71 - 9.57(rate) + 0.79(rate*rate), r² = 0.34.
Dip (6 WAP): Height = 79.78 - 2.48(rate) - 0.016(rate*rate), r² = 0.41.
Drench (6 WAP): Height = 110.24 - 2.94(rate), r² = 0.38.