Research Updates

Paclobutrazol Application Method Influences Growth and Flowering of 'New Gold' Lantana

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Summary. Paclobutrazol was applied as a foliar spray, root-medium drench, and impregnated spike to 'New Gold' lantana grown in 2.8-liter pots. Plants were treated 14 June 1993 at rates of 0, 0.5, and 1.0 mg a.i. paclobutrazol/pot and were harvested 27 July 1993 when control plants required further pruning. Impregnated spikes reduced plant size and flowering to a greater degree than spray applications. Drenches reduced root dry weight and biomass compared to spray applications. Plants treated with 0.5 and 1.0 mg a.i. paclobutrazol/pot were not different in regards to plant growth and flowering. Compared to non-treated controls, plants treated with

paclobutrazol had a reduced growth index, decreased shoot and root dry weight, and fewer flowers with open florets. All plants in the study were marketable, even though growth control was considered excessive. Lower rates than used in this study should be considered for controlling growth. These results suggest that impregnated spike formulations of paclobutrazol may control plant growth in pine bark-based media.

Shrub lantana (*Lantana camara* L.) is a vigorously growing small shrub, which often is used as an annual in the eastern United States for its continuous bloom period during the summer. When grown in containers, lantana requires frequent pruning to maintain plant shape and marketability. 'New Gold' is a prostrate form that produces many golden-yellow flowers. The popularity of 'New Gold' lantana has increased, and the plant recently was selected by the Georgia Plant Selections Committee as a Gold Medal winner for 1995 (Jim Midcap, personal communication).

Paclobutrazol ((2 RS, 3 RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-1,2,4-

triazol-1-yl-penten-3-ol) is labelled for application as a foliar spray or as a root-medium drench (Uniroyal Chemical Co., Middlebury, Conn.). Granular (Ruter, 1992) and spike formulations (Barrett et al., 1994; Deneke and Keever, 1992) are also effective methods for applying paclobutrazol. The purpose of this study was to evaluate the effectiveness of paclobutrazol applied as a foliar spray, root-medium drench, or impregnated spike on the growth control and flowering of 'New Gold' lantana.

Materials and methods

Research was conducted at Wight Nurseries in Cairo, Ga. Fifty-four plants were grown in 2.8-liter pots and pruned to a height of 12 cm on 13 June 1993. The potting medium consisted of a 4 pine bark : 1 sand (v/v) mixture. Liquid fertilizer (10N-1.5P-8.5K) was applied with each irrigation at the rate of 100 mg N/liter. Plants were grown in full sun and irrigated as needed at 20 mm/irrigation using solid-set sprinklers.

Paclobutrazol was applied on 14 June 1993 at the rates of 0, 0.5, or 1.0 mg a.i./pot as a foliar spray, medium drench, or impregnated spike. Foliar sprays (5 ml/plant) and medium drenches (120 ml/plant applied to the surface of the container medium) were applied using Bonzi (1280 mg a.i./liter, Uniroyal Chemical Co.). Spikes (0.25 mg a.i./spike) were identical to Jobe fertilizer spikes (Weatherly Consumer Products, Lexington, Ky.) with paclobutrazol impregnated in the spikes instead of fertilizer. Two or four spikes were positioned vertically in the container medium with the top of the spike even with the surface of the container medium. Spikes were placed equidistant from each other on opposite sides of the plant about 5 cm from

Table 1. Effect of paclobutrazol application method on the growth and flowering of *Lantana camara* 'New Gold' in 2.8-liter containers. Data averaged over application rates of 0.5 and 1.0 mg a.i./pot.

Application method	Growth index ^a	Shoot dry weight (g)	Root dry weight (g)	Biomass ^a (g)	No. of flower heads	No. heads w/open florets
Spray	38.5 a	23.5 a	22.8 a	46.3 a	43 a	24 a
Drench	36.2 a	22.1 a	17.3 b	39.4 b	43 a	21 ab
Spike	31.6 b	19.7 b	15.2 b	34.9 b	29 b	17 b
Significance	**	**	*	**	**	**

^aGrowth index: [(height + width 1 + width 2)/3].

^bBiomass: shoot dry weight + root dry weight.

*,**Significant at $P \leq 0.01$ or 0.05. Mean separation by Waller-Duncan K ratio t test ($n = 36$).

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Table 2. Effect of paclobutrazol application method and treatment on the growth and flowering of *Lantana camara* 'New Gold' in 2.8-liter containers. Data averaged over application rates of 0.5 and 1.0 mg a.i./pot.

Application method	Paclobutrazol treatment	Growth index ^y	Shoot dry wt (g)	Root dry wt (g)	Biomass ^z (g)	No. of flower heads	No. heads w/open florets
Spray	Nontreated	44.1	28.7	30.0	58.7	49	29
	Paclobutrazol	35.7	20.9	19.3	40.2	39	21
	Significance	*	*	*	*	*	*
Drench	Nontreated	40.9	25.6	24.4	50.0	42	23
	Paclobutrazol	33.8	20.3	13.8	34.1	43	19
	Significance	*	*	*	*	NS	*
Spike	Nontreated	44.0	26.5	22.3	48.8	46	28
	Paclobutrazol	25.5	16.4	11.6	28.0	20	12
	Significance	*	*	*	*	*	*

^zBiomass: shoot dry weight + root dry weight.

^yGrowth index: [(height + width 1 + width 2)/3].

^{NS}Nonsignificant or significant P 0.05. Mean separation of nontreated controls with data pooled over rates of 0.5 and 1.0 mg a.i./pot by Dunnett's s_{05} .

the edge of the pot. The experiment was a completely randomized three × three factorial with six plants per treatment combination.

The experiment was terminated 27 July 1993 when nontreated control plants required pruning to remain marketable. Measurements included were growth index [(height + width 1 + width 2 (perpendicular to width 1))/3], shoot dry weight, root dry weight, number of flower heads, and number of heads with open florets. Data were evaluated by analysis of variance. Mean separations were by Wailer-Duncan K ratio and Dunnett's *t* tests where appropriate. Since there were no interactions between application method and rate of paclobutrazol application, only main effects are presented.

Results and discussion

For all measurements, spike applications of paclobutrazol resulted in reduced plant growth and flowering compared to sprays (Table 1). Growth indices were reduced 22%, shoot dry weight decreased 19%, root dry weight 50%, biomass 33%, number of flower heads 48%, and number of flower heads with open florets 41% when plants were treated with spikes compared to spray applications. Drench applications of paclobutrazol were not different from spikes for root dry weight, biomass, and number of flower heads with open florets. Compared to spray applications, drenches resulted in reduced root dry weight and biomass of 32%

and 18%, respectively (Table 1).

For application rate, there were no differences between plants treated with 0.5 and 1.0 mg a.i./pot, so rate data were combined and compared to nontreated control plants. For spray applications, paclobutrazol reduced the growth index by 24%, shoot dry weight by 37%, root dry weight by 55%, biomass by 46%, number of flower heads by 26%, and number of flowers with open florets by 38% (Table 2). With drench applications, treatment with paclobutrazol reduced the growth index by 21%, shoot dry weight by 26%, root dry weight by 77%, biomass by 47%, and number of flowers with open florets by 21% (Table 2). The total number of flower heads was not reduced by drench treatments with paclobutrazol. Spike applications of paclobutrazol reduced all plant growth and flowering by >62% (Table 2).

All plants treated with paclobutrazol had darker green foliage and were very compact due to internode shortening compared to nontreated plants. However, no leaf distortion was noted on plants treated with paclobutrazol. Growth reductions were considered excessive by the grower in this study, although plants remained in marketable condition. Lower rates of paclobutrazol (<0.5 mg a.i./pot) may adequately control growth on 'New Gold' lantana.

Using drench and spike applications of paclobutrazol, Deneke and Keever (1992) found that application method had no effect on the height of

potted tulips (*Tulipa gesneriana* L.). In agreement with the results of our study, Barrett et al. (1994) found no interactions between application method and rate on several floricultural crops. In our study, spike applications were as effective or more effective than drench applications, whereas the spike formulation of paclobutrazol resulted in reduced plant size and flowering compared to spray applications. Barrett et al. (1994) found that paclobutrazol drenches and spikes had similar rate responses on all crops except caladium (*Caladium × hortulanum* Birdsey), in which drenches were more efficacious than spikes. Spikes impregnated with paclobutrazol reduced the growth index, shoot dry weight, and number of flower heads compared to drench applications applied to the pine bark-based medium in our study. Previous research with spikes were conducted with media that did not contain pine bark (Barrett et al., 1994; Deneke and Keever, 1992). However, the efficacy of paclobutrazol applied as a drench was reduced when applied to media containing pine bark (Barrett, 1982; Quarrels et al., 1993). Further work is needed to determine specific paclobutrazol application rates for controlling growth of 'New Gold' lantana and to determine if spikes will be more effective than drenches of pine bark-based media, which commonly are used for container-grown crops.

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