***Cordyline terminalis* Plants Respond to Foliar Sprays and Medium Drenches of Paclobutrazol**

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Abstract. Potted *Cordyline terminalis* L. 'Prins Albert', a foliage plant, was treated with foliar sprays or growth medium drenches of paclobutrazol for plant growth control. Paclobutrazol effectively reduced shoot length measured 4 months following application, the drench being more effective than the spray. Application of paclobutrazol at 200 ppm by either method gave a desirable compact and marketable product. Drench applications at 1000 ppm promoted side-shoot formation. Leaf morphology was altered from an elongated to a more oval form as the paclobutrazol concentration increased, but leaf count was not affected by paclobutrazol, except for the highest drench concentration, which reduced leaf count by 10%. Chemical name used: β -[(4-chlorophenyl)methyl] - α -(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol (paclobutrazol).

The triazol growth retardant paclobutrazol (ICI PP333) is a gibberellin biosynthesis inhibitor that suppresses internode and long-term growth. It is very effective in retarding

growth of various pot plants (Cox and Kever, 1988; McDaniel, 1983; Sanderson et al., 1988; Starman, 1990; Wilkinson and Richards, 1988). In addition, garden landscape plants have been treated with paclobutrazol (Hamada et al., 1990) to develop them as flowering potted crops.

Cordyline terminalis is a common foliage pot plant, with strong apical dominance, that does not put out side branches readily. In the classical method of propagating *C. terminalis*, the rhizome is harvested when the mature plant is repotted and used as new propagation material (Maene and Debergh,

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Fig. 1. Effect of a paclobutrazol (A) foliar spray or (B) medium drench on *Cordyline terminalis* shoot height 60 and 120 days following treatment. Vertical bars indicate SE. Numbers next to lines indicate paclobutrazol concentration (ppm) used.

Fig. 2. Representative leaves of *Cordyline terminalis* plants treated with paclobutrazol by foliar spray (top row) or medium drench (bottom row) at 40, 200, and 1000 ppm (right to left) as compared with the control (middle right).

1982). Some growers plant tissue culture-derived material directly in the final pot (Debergh and Maene, 1981). The objective of this study was to determine the effect of paclobutrazol applications (spray or drench) on *C. terminalis* development, with the ultimate aim of producing a more compact *Cordyline* pot plant product and enhancing branching ability for propagation purposes.

Cordyline terminalis plants, ≈ 8 cm tall and with 15 leaves, were obtained from a commercial nursery and repotted in pots (1.5 liters) containing a 1 tuff (0.1- to 8-mm-diameter particles) : 1 peatmoss mixture. Plants were grown in a hydrosolaric greenhouse (Hagiladi et al., 1980) at 25 to 28°C by day

and 15 to 18°C by night. Plants were fertilized daily with 1 g 20N-9P-17K/liter throughout the study. Paclobutrazol (40, 200, or 1000 ppm) was applied to the plants either as a foliar spray or growth-medium drench. The spray of aqueous paclobutrazol contained 0.1% (v/v) surfactant (Tween 20). With this treatment, the plant foliage was sprayed to runoff (8 ml/plant) while the growth medium was covered with polyethylene to protect it from spray drip. For paclobutrazol drenches, 200 ml/pot of solutions of 0, 40, 200, or 1000 ppm (i.e., 0, 8, 40, and 200 mg a.i./pot, respectively) were applied on the same day as the sprays. The experimental design was a completely randomized block

with 15 single uniform plant replicates per treatment. Shoot height was measured 10, 60, and 120 days after application. The following characteristics were recorded 120 days after paclobutrazol treatment: number of side shoots and leaves and leaf length and width. Statistical analyses were performed using SAS stepwise regression to test the effect of paclobutrazol concentration applied by foliar spray and growth-medium drench on various dependent variables.

Increasing paclobutrazol concentrations reduced plant height (Fig. 1); no clear difference had occurred between spray and drench treatments of the same concentration by 60 days after application, except in the case of the 1000-ppm drench (Fig. 1b). A clear difference in plant response was observed after 120 days between the treated and control plants. Plant height was further reduced in the drench treatment, compared with the foliar spray, using the same concentration (Fig. 1 a and b). Applying paclobutrazol at high concentrations by drench resulted in the formation of new side shoots on lower parts of the plant (2.6 ± 0.7 and 0.4 ± 0.2 side shoots per plant when treated with paclobutrazol at 1000 and 200 ppm, respectively). Paclobutrazol did not affect leaf count, except for the highest drench concentration, which reduced leaf count by 10% ($P = 0.05$). Paclobutrazol application affected leaf size and shape. At 40 ppm, no effects on leaf length were observed (Table 1), while the 200-ppm drench caused a 21% reduction in leaf length as compared with the control, and the same concentration applied as a spray had no effect. At 1000 ppm, leaf elongation was reduced, compared with the control, by 35% and 20% with spray and drench application, respectively. Leaf width increased as a function of increasing paclobutrazol concentration with both methods of application, except for 1000 ppm applied by drench; this concentration resulted in curled leaves and, thus, a decrease of leaf width. This result suggests that the effect of paclobutrazol as a gibberellin biosynthesis inhibitor is at the level of leaf cell elongation. Leaf petiole length was reduced by all paclobutrazol concentrations (Table 1). The effectiveness of the drench treatment was pronounced (up to 46% reduction in petiole length compared with the control), while a similar but less pronounced response was obtained with the 1000-ppm spray treatment.

Paclobutrazol as a medium drench was more effective in modifying the growth of *Cordyline* plants than was spray. The plants responded in several ways: shortened internodes and plant height; alteration of leaf shape from a narrow, elongated form to a more rounded one (Fig. 2); and, at a high concentration, the formation of side shoots at the bottom of the plant. Application of 200 ppm paclobutrazol by foliar spray or medium drench produced a desirable compact, marketable product. Under greenhouse growth conditions, this effect would last 3 to 4 months after treatment, while under indoor conditions it likely would last longer. Paclobutrazol at 1000 ppm was too concentrated to

Table 1. The effect of paclobutrazol (PP333) sprays or drenches on *Cordyline terminalis* leaf length and width and petiole length.

PP333 (ppm)	Leaf length (cm)		Leaf width (cm)		Leaf petiole length (cm)	
	Spray	Drench	Spray	Drench	Spray	Drench
0	29.2*	29.2	7.1	7.1	9.6	9.6
40	29.4	28.2	8.2	9.5	8.5	6.2
200	28.5	23.1	9.4	9.1	6.2	5.6
1000	23.31	10.4	9.1	6.7	5.1	4.5
Significance						
Linear	**					
Quadratic		***	**		**	**
				NS		

^aAverage of 15 replicates.
*, **, ***, ^{NS}Significant at *P* = 0.05, 0.01, or 0.001, or not significant, respectively.

obtain a high-quality product, but can be examined further as a means of increasing side shoot formation for propagation.

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