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Response of Two Forcing Azalea Cultivars to Bonzi and B-nine Applications[1]

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Abstract

Bonzi (paclobutrazol) sprays of 50, 100, and 150 ppm applied either 1 day before or 1 day after cooling reduced bypass shoot number and length of Dorothy Gish White and Roadrunner azaleas (*Rhododendron* × 'Dorothy Gish White' and *R.* × 'Roadrunner') compared to the control. Flowering was delayed 3 to 8 days depending upon cultivar, rate, and time of application, while bloom diameter was reduced slightly (Dorothy Gish White) or not affected (Roadrunner) by paclobutrazol. B-nine (daminozide) had little effect on either bypass shoot development or flowering of Roadrunner, but reduced flower diameter and delayed flowering of Dorothy Gish White azalea relative to the control.

Index words: growth retardant, paclobutrazol, Bonzi, daminozide, B-nine, bypass shoots

Growth regulators used in this study: Bonzi (paclobutrazol) B-[(4-chlorophenyl) methyl]-α-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol; B-nine (daminozide) butanedioic acid mono (2,2-dimethylhydrazide).

Species used in this study: Dorothy Gish White azalea (*Rhododendron* × 'Dorothy Gish White'); Roadrunner azalea (*R.* × 'Roadrunner').

Significance to the Nursery Industry

Bypass shoot development is more extensive when there is excessive time from final pinch to forcing, particularly on certain cultivars forced in January or later for the florist trade. Bonzi (paclobutrazol) application of 50, 100, or 150 ppm suppresses bypass shoot development, while minimally affecting bloom size. However, flowering is likely to be delayed. Applications made just prior to or immediately after cooling were equally effective in controlling bypass shoot development. B-nine (daminozide) is less effective than paclobutrazol in controlling bypass shoot development. Paclobutrazol may provide the grower of azaleas to be used for forcing an additional tool for controlling bypass shoots on late season cultivars.

Introduction

As a result of previous research (4, 5, 6, 9), growers are effectively producing flowering florist azaleas year-round. Florist azaleas respond to long photoperiods, warm temperatures, ample moisture and nutrients with rapid vegetative growth. This rapid growth necessitates frequent pruning to produce well-branched plants before flower buds initiate and develop (8). Short days (1) and growth retardants (1, 7) hasten flower initiation and bud development. Daminozide [butanedioic acid mono (2,2-dimethylhydrazide)] and chlormequat chloride [2,-chloro-N,N,N-trimethylethanaminium chloride)] are the principal growth retardants applied to florist azaleas. Complete flower bud development requires chilling, followed by warm temperatures during forcing. An excessive period from final pinch to the start of forcing usually increases the development of vegetative axillary shoots (bypass shoots) during forcing (3). These shoots often must be removed by the grower or florist before marketing. Bypass shoots are a particular problem on those cultivars forced in January or later (grower comment). In previous research, paclobutrazol (trade name Bonzi, not labeled for florist azaleas) effectively suppressed bypass shoot development of forcing azaleas (2, 10). The objective of this test was to determine if the plant growth retardant currently labeled for florist azaleas, daminozide, or the retardant paclobutrazol could control bypass shoots if applied just prior to or immediately after chilling.

Material and Methods

Uniform 8.9 cm (3.5 in) liners of Dorothy Gish White (mid-season, white) and Roadrunner (late-season, red, readily forms bypass shoots) florist azaleas were potted into 1.5 1 (6 in) containers of peat moss:pine bark shavings (3:2, by vol) growth medium amended with 3.6 kg/m^3 (6 lb/yd^3) SREF 19N-1.3P-5.8K (19-3-7), 3.6 kg/m^3 (6 lb/yd^3) dolomitic limestone, and 0.4 kg/m^3 (0.75 lb/yd^3) Micromax in March 1987. Plants were placed in a double polyethylene greenhouse in a commerical nursery in Semmes, Alabama, and maintained according to common commercial practices. Plants were sheared in July and sprayed the following day with 3627 ppm (2.5 oz/gal) dikegulac sodium [2,3:4,6-bis-0-(1-methylethylidene)-α-L-xylo-2 hexulofuranosonic acid] to increase lateral branching. Six and 8 weeks later, plants were sprayed with 3000 ppm (0.4 oz (wt)/gal) daminozide to suppress vegetative growth and hasten flower bud formation. Plants were held at 4°C (40°F) minimum temperature in a polyethylene greenhouse until February 17, 1988, when they were transferred to a double polyethylene greenhouse at Auburn University and maintained at the same minimum temperature until treatments were applied. Treatments consisted of foliar sprays of 2 growth retardants applied either 1 day before cooling or 1 day after removing plants from the cooler. A single paclobutrazol spray of 50,

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100, or 150 ppm or a single daminozide spray of 3,000 ppm was applied in a volume of 204 ml/m^2 (2 qt/100 ft^2). Sprays were applied using a hand-held sprayer to uniformly wet foliage and stems. A nontreated control was included for comparison. Pre-cooling treatments were applied on February 23, 1988, and all plants were subsequently sprayed with a Benlate®/Daconil® mixture [2 ml each/l (1.5 tsp each/gal)] on February 24 and cooled in the dark at 3°C (38°F) for 4 weeks. Plants were removed from the cooler on March 24 and placed under shade (47% light exclusion) in a double polyethylene greenhouse at 20°C (68°F) minimum night temperature. On March 25, post-cooling treatments of the same rates of paclobutrazol and daminozide were applied. After 3 days, shade cloth was removed and plants were forced in full sun. There were 9 treatments with 5 replicates of 2 plants each completely randomized within a cultivar.

During forcing, plants received a weekly application of 300 ppm N from Peter's 20N-4.3P-16.6K (20-10-20) Peatlite Special. Time until flowering was determined from the time plants were removed from the cooler until 75% of flowers were fully open. At this time, flower number and diameter (3 randomly selected blooms per plant) and bypass shoot number and length (mean length of the 3 longest bypass shoots on each plant) were determined. Rate response to paclobutrazol was determined by regression analysis, and planned comparisons were made with orthogonal contrasts.

Results and Discussion

Bypass shoot number and length of both cultivars decreased as paclobutrazol rate increased (Tables 1 and 2). Applying paclobutrazol after cooling was as effective in controlling bypass shoot development as applying paclobutrazol before cooling, with the exception of shorter bypass shoots on Dorothy Gish White plants treated before cooling. Plants treated with paclobutrazol developed fewer bypass shoots than did daminozide-treated plants or control plants, which developed similar numbers of bypass shoots. Paclobutrazol suppressed bypass shoot length of both cultivars compared to the control and of Dorothy Gish White, but not Roadrunner, compared to daminozide. Daminozide was more effective than the control on Roadrunner but not Dorothy Gish White.

Days to flower for both cultivars increased with increasing rates of paclobutrazol, from 22 days to 29 days for Dorothy Gish White plants and from 33 days to 41 days for Roadrunner plants. The time paclobutrazol was applied relative to cooling did not influence days to flower. Paclobutrazol delayed flowering compared to daminozide and the control, and daminozide delayed flowering of Dorothy Gish White plants compared to the control. Bloom diameter either decreased (Dorothy Gish White) or was not affected (Roadrunner) by increasing rates of paclobutrazol. The decrease with Dorothy Gish White azalea was from 6.3 cm (2.5 in) to 5.8 cm (2.3 in). Daminozide application also resulted in smaller blooms on Dorothy Gish White plants compared to the control. Neither time of application (before or after cooling) nor growth regulator (paclobutrazol vs daminozide) affected bloom diameter of either cultivar.

Paclobutrazol sprays of 50, 100 and 150 ppm reduced bypass shoot number and length of Dorothy Gish White and Roadrunner azaleas compared to untreated plants. The suppression of bypass shoot development agrees with recent findings of Whealy et al. (10) and Keever and Foster (2), although in their work retardants were applied 7–10 weeks before cooling. Time of application, either 1 day before or 1 day after cooling, had little effect on bypass shoot control. Flowering was delayed from 3 to 8 days depending upon cultivar and rate and time of paclobutrazol application. Paclobutrazol reduced bloom diameter of Dorothy Gish White slightly, but not bloom size of Roadrunner. Daminozide had

Table 1. Growth regulator type, time of application, and rate effects on bypass shoot and flower development of Dorothy Gish White azalea.

Growth regulator	Time of application	Rate (ppm)	Bypass shoots Number	Bypass shoots Length[z] (cm)	Days to full bloom[y]	Bloom diameter[x] (cm)
Paclobutrazol	Before[w]	50	4.2	1.5	25.4	5.8
		100	5.2	1.4	27.0	6.0
		150	3.6	1.2	27.0	5.8
	After	50	5.7	2.7	24.7	5.9
		100	6.0	2.6	25.4	5.8
		150	5.4	1.8	28.8	5.9
Daminozide	Before	3,000	9.1	3.4	25.0	5.9
	After	3,000	7.5	3.4	24.0	5.9
Control	—	—	7.7	3.5	22.3	6.3
Significance of contrasts						
Before vs after			ns[v]	*	ns	ns
Paclobutrazol vs daminozide			*	*	*	ns
Paclobutrazol vs control			*	*	*	*
Daminozide vs control			ns	ns	*	*
Significance of paclobutrazol rate[u]			l	l	l	c
Time × rate interaction			ns	ns	ns	ns

[z]Mean length of 3 longest bypass shoots on each plant.

[y]Days to full bloom beginning when plants were moved from cooler to greenhouse.

[x]Mean of 3 randomly selected blooms per plant.

[w]Growth regulator treatments applied either 1 day before or 1 day after cooling.

[v]ns = not significant; * = significant at 5% level.

[u]Control included in regression analysis; l = linear, c = cubic.

Table 2. **Growth regulator type, time of application, and rate effects on bypass shoot and flower development of Roadrunner azalea.**

Growth regulator	Time of application	Rate (ppm)	Bypass shoots Number	Bypass shoots Length[z] (cm)	Days to full bloom[y]	Bloom diameter[x] (cm)
Paclobutrazol	Before[w]	50	11.4	5.6	35.7	5.8
		100	12.3	5.7	38.6	5.8
		150	12.5	5.8	37.5	5.9
	After	50	14.5	5.9	41.0	5.9
		100	10.3	5.9	37.6	5.8
		150	12.3	6.0	40.7	5.9
Daminozide	Before	3,000	15.3	5.4	32.4	5.9
	After	3,000	18.7	5.3	33.0	5.7
Control	—	—	17.3	6.9	32.5	5.8
Significance of contrasts						
Before vs after			ns[v]	ns	ns	ns
Paclobutrazol vs daminozide			*	ns	*	ns
Paclobutrazol vs control			*	*	*	ns
Daminozide vs control			ns	*	ns	ns
Significance of paclobutrazol rate[u]			q	q	q	ns
Time x rate interaction			ns	ns	ns	ns

[z]Mean length of 3 longest bypass shoots on each plant.

[y]Days to full bloom beginning when plants were moved from cooler to greenhouse.

[x]Mean of 3 randomly selected blooms per plant.

[w]Growth regulator treatments applied either 1 day before or 1 day after cooling.

[v]ns = not significant; * = significant at 5% level.

[u]Control included in regression analysis; q = quadratic, ns = not significant.

little effect on bypass shoot development or flowering, except for smaller bloom diameters and delayed flowering of Dorothy Gish White azalea compared to the control.

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