SECTION 7
GROWTH REGULATORS

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Influence of Sumagic Foliar Sprays on Flower Development of Container-Grown Mountain Laurel Cultivars

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Nature of Work: Mountain laurels (*Kalmia latifolia*) are among the most desirable of landscape plants. However, mountain laurels grown in containers rarely develop flower buds during their normal two or three year production cycle thereby limiting retail sales appeal (2,3,4).

Research with the anti-gibberellin paclobutrazol (Bonzi) demonstrated that this class of plant growth regulators could reduce stem elongation as well as increase flower bud production on hybrid rhododendron (6) and azaleas (5). Preliminary work (unpublished) by the senior author demonstrated the potential for both paclobutrazol and uniconazole-P (Sumagic) drench applications to achieve similar results in cultivars of container grown mountain laurel.

However, nurserymen felt drench applications were cumbersome plus differences in varietal response were noted. Spray applications with both chemicals had shown promise (1) with Sumagic eliciting the more consistent responses. Therefore, a test was designed to evaluate the response of three cultivars that sometimes produce leggy growth in containers to spray applications of four rates of Sumagic.

Sumagic solutions were sprayed on 3 gallon container grown mountain laurel at Buds and Blooms Nursery, Brown Summit, NC. Treatments of 0, 50, 100 or 200 ppm Sumagic in water were sprayed to full coverage of all foliage (appx. 1.3 oz. of spray applied per plant) with an air powered 2.44 qt. sprayer. Controls, 0 ppm, were sprayed with water. Treatments were applied in mid May 1995. Except for Sumagic treatments all other cultural practices performed on these plants were the same. The growing medium was pine bark.

There were ten individual plant replicates per cultivar, with treatments randomized within replicates. The cultivars ‘Bullseye,’ ‘Carousel’ and ‘Olympic Fire’ were treated. Height and width measurements were recorded at time of treatment as well as at the end of the growing season then initial measurements were subtracted from season end measurements to yield a figure representative of season growth. The number of flower buds per terminal was recorded at the end of the growing season plus flowering was observed the following spring to determine whether there had been any deleterious affects due to treatment.

Results and Discussion: Height reduction varied by cultivar and treatment (data not shown). 'Bullseye' was not affected until the rate of Sumagic application was increased to 200 ppm. Banko and Stefani (1) did not achieve significant shoot length reduction until a higher concentration, i.e., 300 ppm, was applied to 'Bullseye'. Height of Both 'Carousel' and 'Olympic Fire' was significantly reduced by the 50 ppm application rate with no further significance in height reduction due to increasing rate of application.

Flower bud stimulation by spray application of Sumagic varied by cultivar and rate of application (Table 1). All cultivars had a significant increase in flower bud production due to treatment. However, the rate of response and appearance of plants varied depending upon rate of treatment.

For 'Bullseye,' 200 ppm Sumagic significantly increased the number of terminals with flower buds over the control but not over other rates of treatment. Banko and Stefani (1) achieved significant increase in flower buds as low as 100 ppm with 'Bullseye'. For 'Olympic Fire,' 200 ppm significantly increased the number of terminals with flower buds when compared to controls and 50 ppm, but not 100 ppm. For 'Carousel', 200 ppm significantly increased the number of terminals with flower buds over all other treatments with both 50 and 100 ppm having no significant difference between them, but both 50 and 100 ppm significantly increased the number of terminals with flower bud production over controls.

Table 1. Number of terminals with flower buds on three gallon container grown plants of mountain laurel cultivars as affected by rate of Sumagic spray.

	Cultivar		
ppm Sumagic	Bullseye	Carousel	Olympic Fire
0	0.0b	1.5 c	0.0 b
50	7.8 ab	37.0 b	3.6 b
100	11.8 ab	41.4 b	9.4 ab
200	15.8 a	60.9 a	13.9 a

Rp05 Duncan's New Multiple Range Test

All flower buds opened and developed normally during spring of 1996. When plants were rated for visual appeal at normal time of sale, only the 200 ppm treatment of 'Bullseye' both reduced growth and increased flowering enough to be different from other treatments. 'Olympic Fire' plants treated with either 100 or 200 ppm Sumagic spray had their appearance altered enough to make them more attractive and thereby more salable but the difference between these two treatments was not significant. With 'Carousel,' by far the most responsive cultivar in the test, all plants treated with Sumagic were shorter and, when in bloom, were nearly covered with flowers to the point of masking foliage. The 50 and 100 ppm plants were most attractive with 200 ppm deemed by the grower as too short and too floriferous for the size of the plant.

Significance to the Industry: Sumagic was shown to decrease the height of mountain laurel cultivars while dramatically increasing the number of flowers per plant which should result in greater retail sales. The response was cultivar specific so more investigation of rates of application, timing of application and response of various cultivars is needed.

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Using Incorporated Hydrophilic Polymers as Growth Retardant Carriers

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Nature of Work: Growth retardant drenches are widely used to control the growth of plants because they use low concentrations and less active material, have lower material costs, and are highly effective (1). Nonetheless, Tschabold et al. (6) noted that while the concentration of the drench is low, 61% of the material is lost through leaching. Futhermore, of the 39% remaining, 70% is located in the upper 5 cm (2 in.) of the medium where there may not be enough roots for adequate absorption. Attempts to place and slowly release the growth retardant in the root zone have included encapsulated (4) and granular formulations (1), tablets (5), capsules (5), and injected gels or hydrophilic polymers (5). Hydrophilic polymers are synthetic, water absorbing, unpolymerized compounds that can increase water holding capacity, increase pore size and number, increase nutrient reserves, and reduce soil compaction (3). Orzolek (2) reported that banding a hydrophilic polymer in a furrow reduced total nutrient requirements by increasing the reserve pool of nutrients and increasing the uptake efficiency. The present investigation was conducted to determine if incorporated hydrophlic polymers containing the growth retardants ancymidol (A-Rest™) or paclobutrazol (Bonzi™) increase the reserve pool of the retardants (serve as carriers) and their uptake efficiency.

The potted chrysanthemum cultivars Akira, Cream Dana, Yellow Dana and Rapture were used in individual experiments each with four replications. On November 27, four cuttings were potted per 15 cm (6 -inch) pot containing a growing medium (by volume) of 2:1:1 sphagnum peat moss, vermiculite and perlite amended with 84 g (3 oz.) of dolomitic limestone per ft3. Standard commercial cultural procedures for growing and flowering potted chrysanthemum were followed (7). Plants were fertilized every 2 weeks until buds were 0.8 cm (1/4 in.) in diameter with Peters Peatlite™ 20-10-20 water soluble fertilizer (Scotts, Allentown, PA) at 2 g per liter (2 lb. per 100 gal.). Treatments were: 1) check, no Supersorb C™ (Supersorb C, a hydrophlic polymer manufactured by Aquatrols Inc., Cherry Hill, NJ); 2) preplant incorporated 3 g Supersorb C in 120 ml (4 oz.) of water; 3) preplant incorporated Supersorb C polymer containing 2.5 mg A-Rest™ per pot ; 4) preplant incorporated

Supersorb C™ with 1.25 mg A-Rest™ per pot; 5) preplant incorporated Supersorb C™ with 5.0 mg Bonzi™ per pot; and 6) preplant incorporated Supersorb C™ with 2.5 mg Bonzi™ per pot. Supersorb C™ plus retardant treatments were prepared by mixing 3 g of the polymer, 120 ml (4 oz.) of water, and appropriate amounts of powdered A- Rest™ and Bonzi™ prior to incorporation into a 6 in. azalea pot of media (1.8 liters or 3-1/2 pints). When half the flowers on a pot were open, the plant height, canopy area, number of flowers per pot, flowering date and quality were recorded. Plant canopy area was measured at the top of the plant in two directions and multiplied. Plant quality was rated with the following scale: 0 = dead; 1 = very poor, unsalable; 2 = poor, some salable; 3 = average, salable; 4 = very good, salable; and 5 = excellent, salable.

Results and Discussion: Treatments caused significant differences with all cultivars. The general trend for the growth parameters measured was: 1) no growth differences between the untreated-, Supersorb C™ alone treated-, and the Supersorb C™ plus ancymidol treated- plants; 2) Supersorb C™ with both rates of Bonzi™ yielded plants that differed in growth from the other treatments but not from each other; and 3) Supersorb C™ with high rate of A-Rest™ in some instances and with some cultivars produced retardation equal to the Bonzi™ treatments (Tables 1, 2 and 3). Plants grown in media receiving preplant incorporation of Supersorb C™ with Bonzi™ were shorter, had the smallest plant canopy areas, produced the fewest flowers, were of very poor to poor quality and flowered 11- 12 days later than none- or other- treated plants. The rate of Bonzi™ may have been excessive especially when combined with a hydrophilic polymer.

Significance to Industry: This study shows that incorporated hydrophilic polymers can be effective in carrying growth retardants to plants. Applying Bonzi™ in a hydrophilic polymer showed that a low rate produced the same retardation as a high rate. This result could have environmental and economical significance. Applying a growth retardant in a hydrophilic polymer is a simpler (and probably cheaper) concept than the new concept of encapsulation (4) which pioneered research on more efficient ways to apply growth regulators to media over 20 years ago.

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Table 1. Height and canopy area of four potted chrysanthemum cultivars treated with preplant incorporated Supersorb C™ hydrophilic polymer plus growth retardants A-Rest™ or Bonzi™.

	Cultivars			
Treatment	Akira	Cream Dana	Yellow Dana	Rapture
		Height (cm)[x]		
None	25a[y]	27a	28a	23a
Supersorb C	25a	27a	26a	23a
Supersorb C plus 2.5 mg A-Rest	22a	19b	23ab	17ab
Supersorb C plus 1.25 mg A-rest	23a	28a	25a	19ab
Supersorb C plus 5.0 mg Bonzi	13b	13c	13b	15b
SupersorbC plus 2.5 mg Bonzi	12b	12c	23ab	16b
		Plant Canopy Area (cm2)[x]		
None	1017a[y]	1397a	1652a	1086a
Supersorb C	1172a	1450a	1352a	1246a
Supersorb C plus 2.5 mg A-Rest	858a	862b	1209b	913ab
Supersorb C plus 1.25 mg A-rest	1024a	1332a	1469ab	839ab
Supersorb C plus 5.0 mg Bonzi	526b	498c	675c	351c
SupersorbC plus 2.5 mg Bonzi	443b	432c	466c	562bc

[x]English Conversion 2.5 cm = 1 inch, 100 cm2 =15.5 in.2.
[y]Means in columns followed by the same letter(s) are not significantly different according to Duncan's multiple range test, 5 % level.

Table 2. Number of flowers per pot and flowering date of four potted chrysanthemum cultivars treated with preplant incorporated SupersorbC™ hydrophilic polymer plus growth retardants A-Rest™ or Bonzi™.

	Cultivars			
Treatment	Akira	Cream Dana	Yellow Dana	Rapture
	Number of Flowers Per Pot			
None	54a[x]	43ab	44ab	45ab
Supersorb C	46ab	46ab	41ab	55a
Supersorb C plus 2.5 mg A-Rest	40bc	37abc	40ab	39bc
Supersorb C plus 1.25 mg A-rest	47ab	49a	46a	47ab
Supersorb C plus 5.0 mg Bonzi	31c	34bc	29c	25d
SupersorbC plus 2.5 mg Bonzi	36bc	24c	34c	28cd
	Days to Flowering			
None	82ab[x]	78c	76b	75b
Supersorb C	74b	77c	77b	77b
Supersorb C plus 2.5 mg A-Rest	83ab	83bc	75b	75b
Supersorb C plus 1.25 mg A-rest	83ab	79c	76b	73b
Supersorb C plus 5.0 mg Bonzi	85ab	86ab	86a	85a
SupersorbC plus 2.5 mg Bonzi	87a	90a	83a	82a

[x]Means in columns followed by the same letter(s) are not significantly different according to Duncan's multiple range test, 5 % level.

Table 3. Quality rating of four potted chrysanthemum cultivars treated with preplant incorporated SupersorbC™ hydrophilic polymer plus growth retardants A-Rest™ or Bonzi™.

	Cultivars			
Treatment	Akira	Cream Dana	Yellow Dana	Rapture
	Quality Rating[x]			
None	4.3a[y]	4.0a	4.7a	4.0ab
Supersorb C	3.8a	5.0a	4.0a	5.0a
Supersorb C plus			-	
2.5 mg A-Rest	4.5a	3.6a	4.3a	2.5bc
Supersorb C plus				
1.25 mg A-rest	4.0a	4.7a	4.7a	3.0bc
Supersorb C plus				
5.0 mg Bonzi	1.3b	1.0b	1.0b	1.8c
SupersorbC plus				
2.5 mg Bonzi	1.0b	1.0b	1.0b	1.8b

[x]Quality rating scale: 0= dead; 1= very poor, unsalable; 2= poor, some salable; 3 = average, salable; 4 = very good, salable; and 5 = excellent, salable.

[y]Means in columns followed by the same letter(s) are not significantly different according to Duncan's multiple range test, 5 % level.

Chemical Growth Control of Salvia farinacea 'Victoria Blue'

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Virginia

Nature of Work: *Salvia farinacea 'Victoria Blue'* is an herbaceous perennial species popular for use in perennial and mixed beds and borders. It has a strongly dominant main stem that grows rapidly in the spring. This can be a problem in container production because the plants can quickly grow too tall in proportion to their containers and appear leggy. In this study we evaluated potential materials for reducing apical dominance and promoting more lateral branch growth, with the intention of producing more compact, fully-branched plants.

The first experiment was conducted at a wholesale nursery in Suffolk, Va. (Lancaster Farms, Inc.). Plants obtained as plugs were potted into a pine bark medium in 6 inch (15 cm) containers, April 10, 1995. On April 18, 1995, spray treatments of Florel (ethephon) at 500 and 1000 ppm, Atrimmec (dikegulac) at 1000 ppm, and ProShear (benzyladenine) at 250 ppm were applied with a CO^2-pressurized sprayer set at 32 psi. Untreated plants were left for controls. At the time of treatment the plants were 3-4 cm tall with approximately 8 full-size leaves. A randomized complete block experimental design was utilized with 3 replications, and 3 plants per treatment per replication. Plants were evaluated on May 8 by measuring the overall plant height, length of the main shoot, length of the longest lateral shoot, length of the longest internode on the main shoot, and number of shoots with flower buds. Finally, the grower rated the plants by visual appearance.

The second experiment was conducted at the same wholesale nursery on the same date the following year (April 18, 1996). The most highly rated treatments from the previous year were repeated. These were 500 ppm Florel and 250 ppm ProShear. Additional treatments consisted of applications of the previous two materials followed by an application of 5000 ppm B-Nine eight days later, and manually sheared plants followed by B-Nine eight days later. A randomized complete block experimental design was utilized with five replications and three plants per treatment per replication. These plants were evaluated on May 3 by measuring plant height, width, and length of the longest internode on the main shoot. The plants were also given a visual appearance rating by the grower.

Results and Discussion: In the first experiment the preferred treatments were 500 ppm Florel and the 250 ppm ProShear (Grower evaluation, Table 1). These treatments suppressed the main shoot length but allowed growth of lateral shoots to produce fuller appearing plants. This fuller appearance is reflected in an increased lateral shoot/main shoot length ratio. The 1000 ppm Florel and the 1000 ppm Atrimmec treatments also suppressed main shoot length and the plants were nicely shaped but a little too small. Also, the Atrimmec treatment caused some foliar chlorosis for about two weeks and, the leaves had a somewhat elongated or straplike appearance. The preferred treatments in the second experiment were the Florel + B-Nine and the ProShear + B-Nine (Table 2). Both of these treatments produced full, nicely branched plants that were not excessively leggy. The ProShear alone and the untreated plants were rated lowest because both were judged by the grower to be too leggy. The manually sheared + B-nine plants were judged to be too small and with an unnatural appearance (no dominant main shoot).

Significance to the Industry: *Salvia farinacea 'Victoria Blue'* may be produced as compact, fully-branched plants with spray applications of 500 ppm Florel or 250 ppm ProShear followed by a 5000 ppm B-nine spray about 8 days later. ProShear, however, is not currently labeled for this purpose.

Acknowledgments: We would like to thank Lancaster Farms Wholesale Nursery, Suffolk, VA, for the plants used for this study, and for the assistance of Mr. Sam Saunders in evaluating the plants.

Table 1. Experiment 1. Growth response of Salvia farinacea Victoria Blue to foliar application of Florel, Atrimmec, or ProShear. 1995.

	Treatments				
	Control	Florel	Florel	Atrimmec	ProShear
Growth Response	(no treatment)	500 ppm	1000 ppm	1000 ppm	250 ppm
Plant height (cm)	18.0 a[z]	15.0 bc	13.1 c	12.3 c	16.8 ab
Plant width (cm)	22.2 a	21.0 ab	18.9 c	19.4 bc	22.4 a
Growth Index	20.1 a	18.0 ab	16.0 b	15.9 b	19.6 a
Number of shoots with flowers showing color	1.8 ab	2.8 a	1.2 b	0.4 b	2.8 a
Length of main shoot (cm)	17.9 a	14.6 bc	12.8 c	12.3 c	16.7 ab
Length of longest lateral shoots (cm)	11.6 abc	11.9 ab	9.4 c	10.0 bc	13.3 a
Lateral shoot/ main shoot length ratio	0.7 b	0.8 a	0.7 ab	0.8 a	0.8 a
Length of longest internode (cm)	3.2 ab	2.6 bc	2.3 c	2.8 abc	3.4 a
Grower Evaluation[y]	2.0 c	4.0 a	3.0 b	3.0 b	3.7 a

z Mean separation in rows by LSD, $P \leq 0.05$.

[y] Grower Evaluation (appearance rating): 1 = least desirable appearance; 4 = most desirable appearance.

Table 2. Experiment 2. Growth response of Salvia farinacea Victoria Blue to Florel, ProShear, and B-Nine. 1996.

	Treatments					
	Control	Manual shear	Florel	Florel 500 ppm	ProShear	ProShear 250ppm
Growth Response	no treatment	+ B-Nine	500 ppm	+ B-Nine	250 ppm	+ B-Nine
Plant height (cm)	18.5 a[z]	9.1 d	15.6 b	9.3 d	18.8 a	12.5 c
Plant width (cm)	21.1 a	19.2 b	19.4 b	18.5 b	21.6 a	20.7 a
Internode length	4.2 b	3.4 c	3.3 c	1.8 d	4.8 a	3.0 c
Grower Evaluation[y]	1.1 c	2.9 b	2.7 b	3.7 a	1.3 c	3.8 a

[z] Mean separation in rows by LSD, $P \leq 0.05$.
[y] Grower Evaluation (appearance rating): 1 = least desirable appearance; 4 = most desirable appearance.

Timing of Sumagic Application Influences Kalmia Flower Bud Initiation and Plant Size

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Virginia

Nature of Work: In an earlier report, we showed that spray applications of uniconazole (Sumagic) could promote flower bud initiation on *Kalmia latifolia* (mountain laurel) when applied in the spring after the first growth flush (1). However, there was also some reduction in plant size because shoot elongation of subsequent growth flushes during the growing season was retarded. In this study, we compared Sumagic treatments applied after the first growth flush with Sumagic treatments applied later in the season after the second growth flush. Comparisons were made both for flower bud initiation and for overall plant size at the end of the growing season.

The Kalmia cvs. utilized in this study were ‘Nipmuck’, ‘Olympic Fire’, and ‘Bullseye’. Two different size (age) plants were evaluated; 2 gallon (beginning their 2nd season of growth) and 5 gallon (beginning their 3rd season of growth). All of the plants were growing in a pine bark medium. The first set of treatments was applied after the first growth flush of the season on May 26, 1995. The plants were sheared lightly just prior to treatment application. The second set of treatments was applied to a different group of plants following the second growth flush on July 20, 1995. These plants were not sheared prior to treatment application, but they had been sheared after their first growth flush at the same time as the first group of plants. The treatments were spray applications of Sumagic at concentrations of 0, 25, 50, 100, 150, and 200 ppm, applied to runoff. There were 5 plants per treatment for each cv. in a completely randomized experimental design. The plants were evaluated on November 11, 1995 by counting flower bud clusters (corymbs) and by measuring plant height. The 5 gallon ‘Bullseye’ plants were not evaluated due to excessive losses apparently from Phytophthora root rot. The Sumagic concentration effects and the application time effects were analyzed with analysis of variance (ANOVA), with mean separation by LSD, $P \leq 0.05$.

Results and Discussion: Promotion of flower bud set with Sumagic on the 2-gal. plants depended on the cultivar and the growth flush to which the treatment was applied. With ‘Nipmuck’ (Table 1), treatments to the 2-gal. plants had little effect on bud set whether applied after the first or the second flush. With the other two cvs. (Tables 2 and 3), however, treatments applied after the second flush, but not after the first, significantly increased flower bud set. Application after the second flush also resulted in larger plants. Application of treatments to the 5-gal. plants increased bud set for all cvs. whether applied to the first or the second growth flush. Application following the second flush again produced larger plants in most cases. It appears that 50 ppm is the concentration at which significant increases in flower bud set usually occur for both 2-gal. and 5-gal. plants, with possible slight variations among cultivars.

Significance to the Industry: Spray treatments of Sumagic in the range of 50 to 200 ppm significantly increased flower bud set on *Kalmia latifolia.* Application to the second growth flush of the season was at least as effective as to the first flush, and resulted in larger plants at the end of the growing season. Treatments were most effective when applied to plants in their 3rd year of production but significant increases in bud set also occurred on plants in their second year of production for two of the three cvs. evaluated.

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Table 1. *Kalmia* 'Nipmuck'. Plant height and number of flower bud clusters as affected by Sumagic application after the first or the second growth flush of the season to 2 gallon (1 year) or 5 gallon (2 year) plants.

Table 1. Kalmia 'Nipmuck'. Plant height and number of flower bud clusters as affected by Sumagic application after the first or the second growth flush of the season to 2 gallon (1 year) or 5 gallon (2 year) plants.

	Application after 1st growth flush (May 26, 1995)			
	2 gallon size		5 gallon size	
Sumagic Rate (ppm)	Bud Clusters	Height (cm)	Bud Clusters	Height (cm)
0	0.0	43.2	0.0	71.4
25	0.0	32.4*	0.2	71.2
50	0.0	26.8*	42.2*	59.8*
100	0.0	29.2*	32.2*	53.2*
150	0.2	24.0*	42.2*	51.8*
200	0.0	23.8*	90.0*	50.8*
LSD[Z]	0.2	4.9	31.5	5.9
	Application after 2nd growth flush (July 20, 1995)			
0	0.0	53.2	1.6	73.6
25	0.0	41.8*	8.2	65.4*
50	0.0	36.0*	18.4	54.4*
100	0.2	35.0*	71.6*	64.4*
150	8.2*	36.0*	59.8*	57.0*
200	1.8	37.8*	65.4*	59.2*
LSD	8.0	5.0	29.0	6.5
Significance[Y]				
Application time	NS	****	NS	*
Rate	NS	****	****	****
Appl. time x Rate	NS	NS	*	***

[Z] Mean separation within columns by least significant difference. * indicates significant difference from ~e control (0 ppm) treatment at the 5% level.

[Y] Significance of indicated factor by Analysis of Variance (ANOVA). NS, *, **, ***, ****: not significant or significant at $P \leq 0.05$, $P \leq 0.01$, $P \leq 0.001$, or $P \leq 0.0001$, respectively.

Table 2. Kalmia 'Olympic Fire'. Plant height and number of flower bud clusters as affected by Sumagic application after the first or the second growth flush of the season to 2 gallon (1 year) or 5 gallon (2 year) plants.

	Application after 1st growth flush (May 26, 1995)			
	2 gallon size		5 gallon size	
Sumagic Rate (ppm)	Bud Clusters	Height (cm)	Bud Clusters	Height (cm)
0	0.0	54.8	0.0	85.0
25	2.4	35.0*	2.2	72.8*
50	0.0	31.0*	20.8*	60.2*
100	0.0	30.0*	33.2*	59.0*
150	2.0	29.4*	63.8*	57.8*
200	0.0	30.0*	86.0*	55.8*
LSD[Z]	3.0	4.9	27.9	7.0
	Application after 2nd growth flush (July 20, 1995)			
0	0.2	46.6	0.0	81.8
25	9.4	38.8*	5.6	70.6*
50	27.0*	39.6*	32.8*	73.8*
100	24.0*	39.0*	54.4*	71.0*
150	19.0*	36.8*	33.0*	68.4*
200	17.8*	37.6*	35.6*	68.0*
LSD	14.7	4.2	15.5	3.8
Significance[Y]				
Application time	****	****	NS	****
Rate	**	****	****	****
Appl. time x Rate	**	****	****	****

[Z] Mean separation within columns by least significant difference. * indicates significant difference from the control (0 ppm) treatment at the 5% level.

[Y] Significance of indicated factor by Analysis of Variance (ANOVA). NS, *, **, ***, ****: not significant or significant at $P \leq 0.05$, $P \leq 0.01$, $P \leq 0.001$, or $P \leq 0.0001$, respectively.

Table 3. ***Kalmia*** **'Bullseye'.** Plant height and number of flower bud clusters as affected by Sumagic application after the first or the second growth flush of the season to 2 gallon (1 year) or 5 gallon (2 year) plants.

	Application after 1st growth flush (May 26, 1995)			
	2 gallon size		5 gallon size	
Sumagic Rate (ppm)	Bud Clusters	Height (cm)	Bud Clusters	Height (cm)
0	2.0	64.0		
25	7.2	58.6		
50	0.6	45.8*		
100	7.2	37.0*		
150	4.0	38.2*		
200	6.6	35.0*		
LSD[Z]	9.2	11.7		
	Application after 2nd growth flush (July 20, 1995)			
0	7.4	52.8	53.0	70.8
25	24.0	43.4*	47.8	72.2
50	33.8*	43.0*	71.2	65.2
100	37.6*	46.8*	98.6*	67.2
150	33.6*	43.2*	81.0*	65.8
200	20.2	43.0*	?2.4	66.2
LSD	18.0	6.9	25.0	9.9
Significance[Y]				
Application time	****	NS	—	-
Rate	*	****	**	NS
Appl. time x Rate	*	***	—	-

[Z] Mean separation within columns by least significant difference. * indicates significant difference from the control (0 ppm) treatment at ~e 5% level.

[Y] Significance of indicated factor by Analysis of Variance (ANOVA). NS, *, **, ***, ****: not significant or significant at $P \leq 0.05$, $P \leq 0.01$, $P \leq 0.001$, or $P \leq 0.0001$, respectively.

Influence of Paclobutrazol on Growth of Wintercreeper Euonymus

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Nature of Work: Wintercreeper euonymus (*Euonymus fortunei var. coloratus*) is a vigorous growing groundcover which is often used in the eastern United States for the plum-purple color of its winter foliage. When grown in containers, wintercreeper euonymus requires frequent pruning to maintain plant shape and marketability.

Paclobutrazol (Bonzi) is labelled for application as a foliar spray or as a root-medium drench (Uniroyal Chemical Co., Middlebury, Conn.). The purpose of this study was to evaluate the effectiveness of paclobutrazol applied as a root-medium drench on the growth control of wintercreeper euonymus.

Research was conducted at the Coastal Plain Experiment Station in Tifton, Ga. Thirty plants were grown in #1 pots and pruned to a height of 10 cm on 3 June 1995. The potting medium consisted of a 8 pine bark : 1 sand (v/v) mixture amended with 5 lbs./cu. yd. dolomitic limestone and 1.5 lbs./cu. yd. Micromax (Grace-Sierra, Milpitas, Ca.). Each container was topdressed at planting with 0.7 oz (20 g) of Perma-Green 21-3-12 (Graco Fertilizer, Cairo, Ga.). Plants were grown in a shade house with 55% light exclusion and irrigated as needed at 1/2 in. per irrigation using solid set sprinklers.

Paclobutrazol was applied on 15 June 1995 at the rates of 0, 1.0, 2.0, 5.0, and 10.0 mg a.i./pot as a medium drench. Medium drenches (4 oz./plant applied to the surface of the container medium) were applied using Bonzi (0.128%, Uniroyal Chemical Co.). The experiment was arranged as a completely randomized design with six replicate plants per treatment.

The experiment was terminated on 15 October 1995 when untreated control plants required pruning to remain marketable. Measurements taken at the termination of the study were plant height, growth index [(height + width 1 + width 2 (perpendicular to width 1))/3], shoot dry weight, and root dry weight. Data were evaluated by analysis of variance and regression analysis.

Results and Discussion: Plant height, growth indices, shoot dry weight and root:shoot ratio (root dry weight/shoot dry weight) all decreased linearly as rate of paclobutrazol increased. At the highest rate of application (10 mg a.i./pot), plant heights were reduced 36% and the growth indices were reduced 49% compared to non-treated plants. Plants treated with 5.0 mg a.i./pot of Bonzi resulted in commercially acceptable control of plant growth. At 5.0 mg a.i./pot, plant heights were reduced 32% and growth indices were reduced 12% compared with non-treated plants. Bonzi applied as a root medium drench at rates of 1.0 and 2.0 mg a.i./pot did not provide adequate control of plant growth.

Bonzi reduced shoot dry weight by 22% and 57%, respectively, for plants treated at the rates of 5 and 10 mg a.i./pot compared to control plants. Bonzi application had no effect on root dry weight; however, the root:shoot ratio increased from 2.1 (control) to 3.3 (5 mg a.i./plant) which indicated a preferential partitioning of photoassimilates for root system development.

Significance to Industry: Bonzi was applied as a root-medium drench to wintercreeper euonymus grown in #1 pots. Plant height, growth indices and shoot dry weight were reduced by applications of Bonzi at rates greater than 2 mg a.i./pot. The root:shoot ratio of plants increased as rate of Bonzi increased. The results of this study indicate that a Bonzi treatment of 5 mg a.i./pot applied as a root medium drench may effectively control vegetative growth and reduce the required pruning necessary to produce a salable #1 container of wintergreen euonymus.