Cutless and Atrimmec for Controlling Growth of Woody Landscape Plants in Containers[1]

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Abstract

Cutless (flurprimidol) effectively reduced shoot elongation of container-grown woody ornamentals, including abelia, cotoneaster, crape myrtle, Foster holly, Mystery gardenia, Manhattan euonymus, photinia and rhododendron. Optimum Cutless 50W (flurprimidol) spray rates were 500–600 ppm for most species except for Manhattan euonymus (1250 ppm), Mystery gardenia and Natchez crape myrtle (750 ppm). Optimum Cutless 0.33G (flurprimidol) granular rates were 0.6 kg/ha (0.5 lb/A) for Coral Beauty cotoneaster and Foster holly, and 1.7 kg/ha (1.5 lb/A) for Fraser photinia. Atrimmec (dikegulac) was effective in controlling growth of abelia at spray rates of 1480 ppm, Coral Beauty cotoneaster, and Manhattan euonymus at 1600 ppm, Foster holly, and Fraser photinia at 4440 ppm. Neither Off-Shoot-O nor Trim-Cut (mefluidide) had a significant effect on any of the species studied. None of the growth regulators had a significant effect on nandina.

Index words: growth regulators, woody landscape plants, container production.

Species used in this study: glossy abelia (*Abelia* x *grandiflora* (Andre) Rehd.); bearberry cotoneaster (*Cotoneaster dammeri* C.K. Schneid. 'Coral Beauty'); Manhattan euonymus (*Euonymus kiautschovicus* Loes. 'Manhattan'); Mystery gardenia (*Gardenia jasminoides* Ellis 'Mystery'); Foster holly (*Ilex* x *attenuata* Ashe 'Fosteri'); Natchez crape myrtle (*Lagerstroemia (indica* x *fauriei)* 'Natchez'); nandina (*Nandina domestica* Thunb.); Fraser photinia (*Photinia* x *fraseri* Dress); Nova Zembla rhododendron (*Rhododendron catawbiense* Michx. 'Nova Zembla').

Growth regulators used in this study: Cutless 50W, 0.33G (flurprimidol), α-(1-methylethyl)-α-[4-trifluoromethoxy)phenyl]-5-pyrimidine-methanol; Atrimmec (dikegulac), 2,3:4,6 bis-o-(1-methylethyldiene)-o-1-xylo-2-hexulofuranosonic acid; Off-Shoot-O (methyl esters of fatty acids); Trim-Cut (mefluidide), N-[2,4-dimethyl-5-[[(trifluoromethyl)-sulfonyl]amino]phenyl] acetamide.

Significance to the Nursery Industry

Many woody plant species grow rapidly during container production, requiring frequent pruning or shearing to maintain desirable size and form. Both Cutless (flurprimidol) and Atrimmec (dikegulac) were effective in controlling shoot elongation of abelia, cotoneaster, Foster holly, euonymus, and photinia. Cutless (flurprimidol) also controlled growth of Mystery gardenia and crape myrtle, while Atrimmec (dikegulac) did not. Cutless (flurprimidol) achieved reduced shoot elongation and compactness by reducing internode length without stimulating additional shoot production which can occur with Atrimmec (dikegulac). Cutless (flurprimidol) was effective both as a spray and as a granular application. Optimum spray rates for Cutless (flurprimidol) were 500–600 ppm for most species except for Manhattan euonymus (1250 ppm), gardenia and crape myrtle (750 ppm). In general, Cutless (flurprimidol) treatments had longer-lasting effects than Atrimmec (dikegulac) for those species that responded to both chemicals. Trim-cut (mefluidide) had no significant effect on any of the species tested. None of the growth regulators was effective in controlling growth of nandina.

Introduction

Nursery production of container-grown woody plants may require a substantial amount of labor (and expense) to trim or shear the plants to establish or improve plant form, maintain the plant size in relation to its container, and facilitate handling and transportation. Careful use of chemical growth regulators could eliminate or reduce the need for shearing. Cutless (flurprimidol) is a growth regulator which reduces growth by inhibiting the synthesis of gibberellins (7). It is currently registered as a turfgrass growth regulator. It has also reduced shoot growth of mature trees in the landscape (1, 6) and several species of shrubs (4, 5). In this study we examined the growth response of some container-grown shrubs to Cutless (flurprimidol). Comparisons were made with Atrimmec (dikegulac) and Off-Shoot-O, a chemical pinching agent, in the first experiment, and with Atrimmec (dikegulac), and Trim-cut (mefluidide) in the second experiment. Species selected require frequent pruning or shearing during the growing season to maintain optimum size and shape.

Materials and Methods

Experiment 1. Abelia x *grandiflora*, *Cotoneaster dammeri* 'Coral Beauty', *Ilex* x *attenuata* 'Fosteri', *Photinia* x *fraseri*, and *Rhododendron* 'Nova Zembla' were treated. All plants were grown in a medium of pine bark and sand (4:1 by vol), amended with 2.4 kg/m^3 (4 lbs/yd^3) dolomitic limestone, 7.7 kg/m^3 (13 lbs/yd^3) Osmocote 17N-3P-10K (17-7-12) and 0.9 kg/m^3 (1.5 lbs/yd^3) Micromax (Grace Sierra Chemical Co. Milpitas, CA). Abelia were in 2.8 liter (#1) containers; other species were in 11.4 liter (#3) containers. The plants were in their second season of growth at a wholesale nursery in Suffolk, VA. The plants were sheared lightly to a uniform size and shape, by species, immediately prior to application of the growth regulator treatments. The Off-Shoot-O treatment and untreated controls were left unsheared. There were

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5 single-plant replicates per treatment in a completely randomized design.

Spray treatments of Cutless 50W (flurprimidol), Atrimmec (dikegulac), Off-Shoot-O, and a water control were applied with a CO_2-pressurized sprayer at 30 psi, with sufficient volume to completely wet the foliage. Cutless 50W (flurprimidol) treatments provided active ingredient (ai) concentrations of 600, 800, and 1000 ppm. Atrimmec (dikegulac) was applied to abelia at 1480 ppm, and to the remaining species at 4440 ppm (label recommendations). Off-Shoot-O was applied to unsheared plants at the label recommendation of 94 ml/liter (3 oz/qt).

Cutless 0.33G (flurprimidol) (granular) was applied manually to the surface of the container medium at rates of 0.6, 1.1, and 1.7 kg/ha ai (0.5, 1.0, and 1.5 lb/Acre or 5, 10, and 15 mg/ft^2 ai, respectively). Treatments were applied May 9, 1991. Ambient air temperature was 20C (68F). Plant heights and widths (widest point + narrowest point / 2) were measured in random order between August 28 and September 4, 1991. The abelia and cotoneaster were also given visual numerical ratings for green color at this time. Data were analyzed by ANOVA and mean separations by LSD, $P \leq 0.05$. Responses to Cutless (flurprimidol) rates (trend comparisons) were determined by orthogonal polynomial contrasts (2) with contrast coefficients for unequal treatment levels calculated according to Khanizadeh and Fanous (3).

Experiment 2. In 1992, a second experiment was initiated to evaluate the growth retardation effects of Cutless 50W (flurprimidol) and Atrimmec (dikegulac) on additional species over time. Trim-Cut (mefluidide), was also evaluated.

Treatments were applied to *Cotoneaster dammeri* 'Coral Beauty', *Euonymus kiautschovicus* 'Manhattan', *Gardenia jasminoides* 'Mystery', *Lagerstroemia (indica* x *fauriei)* 'Natchez' (crape myrtle), *Nandina domestica* and *Photinia* x *fraseri.* Cotoneaster, nandina, and photinia were in 2.8 liter (#1) containers. Crape myrtle, euonymus, and gardenia were in 11.4 liter (#3) containers. The container medium with amendments, shearing, and growth regulator spray applications were as described in Experiment 1.

Cutless 50W (flurprimidol) was applied at 0 (control), 500, 750, 1000, 1250, and 1500 ppm (ai). Atrimmec (dikegulac) was applied at 1600 ppm to cotoneaster and euonymus; 3200 ppm to crape myrtle, and 4800 ppm to gardenia, nandina, and photinia, according to label recommendations. Trim-cut (mefluidide) was applied at 1600 ppm, the approximate rate recommended for most shrubs on the label. There were 5 single-plant replicates per treatment in a completely randomized design. Each plant species was treated as a separate experiment. All treatments were applied June 1, 1992, when the air temperature was approximately 22C (75F). Heights and widths of the plants were measured at 8 weeks post-treatment (July 28). At 13-weeks post treatment (September 2), heights and widths were again measured for cotoneaster, euonymus, nandina, and photinia. Because of their spreading growth habits, the 2 longest shoots per plant were measured for crape myrtles and gardenias. At this same time, a representative shoot from each species (except nandina) was collected from each plant and internodes were counted and measured. The number of primary shoots produced after treatment was counted for euonymus, photinia, and gardenia. Data were analyzed as described for experiment 1.

Results and Discussion

Experiment 1. Treatment effects on abelia were most evident in the width measurements due to its spreading growth habit. All Cutless (flurprimidol) treatments on abelia resulted in more compact plants with shorter internodes (data not shown). A linear reduction in plant width was obtained with increased rates of the Cutless 50W (flurprimidol) treatment (Table 1). The 1.7 kg/ha (1.5 lb/A) Cutless 0.33G (flurprimidol) treatment also provided a reduction in width (LSD: $P \leq 0.05$). Abelia was most responsive to the Atrimmec (dikegulac) spray which produced very compact plants and appeared to increase branching and shoot development toward the center of the plant (no data). None of the treatments affected color rating for abelia (data not shown).

Coral Beauty cotoneaster has a prostrate growth habit. Cutless (flurprimidol) and Atrimmec (dikegulac) reduced

Table 1. Growth response (cm) of five woody landscape species treated with growth regulators, Experiment 1 (16 weeks after treatment).

		Species									
		Abelia		Cotoneaster		Foster Holly		Photinia		Rhododendron	
Treatment	Rate	Height	Width	Height	Width	Height	Width	Height	Width	Shoot length	Shoot number
Trimmed control	0	42.2	67.0	54.2	108.0	82.0	51.4	109.2	56.9	9.4	20.0
Cutless W	600 ppm	32.0	59.1	41.0	76.8	56.6	39.1	67.2	55.0	6.2	12.4
Cutless W	800 ppm	36.2	52.3	34.6	60.3	56.0	36.8	63.2	46.6	6.4	15.4
Cutless W	1000 ppm	6.6NS[x]	55.5L	34.2L	57.4L	50.2L	36.8L	74.8Q	50.2NS	5.8L	16.0Q
Cutless G	0.6 kg/ha	34.0	56.0	33.2	71.3	65.2	42.5	96.8	62.0	8.0	17.6
Cutless G	1.1 kg/ha	35.4	55.6	29.8	69.5	64.8	40.1	78.2	54.5	7.1	15.8
Cutless G	1.7 kg/ha	32.4NS	3.3NS	30.6Q	58.9L	52.6L	41.2Q	74.8L	62.8NS	6.5L	15.2L
Atrimmec[y]		26.8	43.7	41.4	62.6	54.2	47.1	84.0	55.0	8.9	21.0
Untrimmed control	0	36.4	61.3	40.8	117.8	137.6	58.7	126.8	63.8	9.7	18.6
LSD[z]		12.5	13.6	10.3	17.6	12.4	5.9	18.8	10.5	1.9	4.7

[z]Mean separation within columns, $P \leq 0.05$.

[y]Atrimmec concentration: 1480 ppm for abelia; 4440 ppm for cotoneaster, Foster holly, photinia, and rhododendron.

[x]Significance of regression analysis at $P \leq 0.05$: L = linear; Q = quadratic; NS = not significant. Trimmed control included in regression.

Table 2. Growth response of *Cotoneaster dammeri* 'Coral Beauty' and *Euonymus kiautschovicus* 'Manhattan' to foliar application of Cutless, Atrimmec, or Trim-Cut, Experiment 2.

		Species								
		'Coral Beauty' Cotoneaster					'Manhattan' Euonymus			
		8 Weeks		13 Weeks after treatment			8 Weeks		13 Weeks after treatment	
Treatment	Concentration (ppm)	Height (cm)	Width (cm)	Height (cm)	Width (cm)	Internode length (cm)	Height (cm)	Width (cm)	Height (cm)	Width (cm)
Control	0	21.8	43.6	29.8	55.1	0.6	55.0	68.0	67.0	76.0
Cutless W	500	16.8	29.9	20.8	38.5	0.4	52.2	66.1	56.0	79.2
Cutless W	750	17.4	27.2	18.0	33.8	0.4	52.2	63.3	57.8	83.4
Cutless W	1000	16.2	31.9	18.0	42.9	0.3	53.0	64.3	55.2	75.1
Cutless W	1250	14.2	25.9	16.2	33.4	0.3	44.0	56.6	56.0	71.1
Cutless W	1500	15.4	26.9	17.4	37.0	0.4	45.2	50.1	54.6	70.8
Regression significance[z]		L***	Q*	Q***	Q**	Q**	L**	L***	L**	Q*
Atrimmec	1600	12.6	20.1	25.6	38.1	0.8	40.6	52.9	51.6	69.8
Trim-Cut	1600	20.6	39.6	28.2	57.7	0.6	52.0	59.7	69.0	75.5
LSD[y]		4.0	6.9	4.2	10.2	0.2	8.1	9.3	8.2	8.9

[z]Significance of regression analysis at $P \leq 0.05$ (*), .01 (**), .001 (***). L = linear; Q = quadratic; control included in regression.

[y]Mean separation within columns by LSD, $P = 0.05$.

shoot elongation and plant width. Attractive, compact plants were obtained with Cutless 50W (flurprimidol) at 600 ppm and with Cutless 0.33G (flurprimidol) at 0.6 kg/ha (0.5 lb/A). Atrimmec (dikegulac) produced compact cotoneaster plants at the recommended rate. Untreated cotoneasters grew very long, trailing stems. Cutless W (flurprimidol, 600 and 1000 ppm)- and Atrimmec (dikegulac)-treated cotoneasters were darker green than the control plants (data not shown). Darker green foliage has also been reported for other Cutless (flurprimidol)-treated shrubs (4, 5).

Foster hollies tend to develop a strong, sparsely-branched main leader. A 600 ppm spray or 0.6 kg/ha (0.5 lb/A) Cutless G (flurprimidol) prevented the main leader from elongating excessively, producing attractive, compact shrubs. A linear height response to Cutless (flurprimidol) rates was obtained but the lower rates provided adequate growth control. Atrimmec (dikegulac) also produced compact hollies, with more dense shoot growth than the controls and Cutless-treated plants due to an apparent stimulation of branching (no data).

The 600 ppm Cutless (flurprimidol) spray treatment provided effective growth control for photinia. A quadratic rate response suggests little additional benefit at higher rates. A linear response to the granular treatments indicates more control at the higher rate (1.5 lb/A). Treated plants were more compact than the controls but appeared normal otherwise. Atrimmec (dikegulac) also provided growth control although it was not as effective as Cutless (flurprimidol).

Cutless (flurprimidol) suppressed the length of new rhododendron shoots; however, it also reduced the number of new shoots produced (Table 1), a disadvantage because of the open growth of rhododendron. Atrimmec (dikegulac) had no effect on rhododendron in this study. None of the treatments affected the number of flower buds formed (data not shown).

The Off-Shoot-O treatment had no significant effect on any of the plants evaluated (data not shown).

Experiment 2. Linear suppression of plant height with increased rate was the primary effect of Cutless (flurprimidol) on Manhattan euonymus (Table 2). There was an apparent delay in height response to lower rates of Cutless (flurprimidol). Eight weeks after treatment, heights from the 500–1000 ppm treatments remained about 95% of the controls. At 13 weeks, these same plants were about 84% as tall as the controls. This response could be unusual for Manhattan euonymus. Keever and Gilliam (4) found that for *Buddleia davidii,* growth retardation decreased from 60 to 90 days after treatment, roughly the same time frame. The vigorous growth habit of euonymus may help explain this delayed response. Atrimmec (dikegulac) was the most effective treatment overall, resulting in shorter, fuller-appearing plants with more new shoots than the controls (40.2 new shoots per plant vs. 25.2 for the controls). Trim-Cut had no significant effect on Manhattan euonymus.

For Coral Beauty cotoneaster, all of the Cutless (flurprimidol) treatments and the Atrimmec (dikegulac) treatment reduced height and horizontal extension (width) 8 weeks post-treatment (Table 2). The Atrimmec (dikegulac)-treated plants were the smallest at that time. At 13 weeks post-treatment, the Cutless (dikegulac)-treated plants were the most compact, indicating that Cutless (flurprimidol) had a longer residual effect than Atrimmec (dikegulac). There was a consistent quadratic Cutless (flurprimidol) rate effect on plant width with little additional growth suppression occurring at rates above 750 ppm both 8 and 13 weeks post-treatment. Growth suppression from 8 to 13 weeks remained about the same, with width of 750 ppm-treated plants being 62% and 61% of the controls, and of 1250 ppm-treated plants approximately 60% of the controls 8 and 13 weeks post-treatment, respectively. Upright growth of the Cutless (flurprimidol)-treated plants was limited due to shortened internodes, giving them a more prostrate form than either the control or the other treatments. Trim-Cut (mefluidide) had no effect.

Unsheared and untreated new shoots of Mystery gardenia are long and brittle at the base and subject to breakage. As Cutless (flurprimidol) rates increased, gardenia height decreased linearly 8 weeks post treatment. Shoot lengths decreased quadratically 13 weeks post-treatment with the great-

Table 3. **Growth response of *Gardenia jasminoides* 'Mystery' and *Lagerstroemia* (*indica* x *fauriei*) 'Natchez' to foliar application of Cutless, Atrimmec, or Trim-Cut, Experiment 2.**

		Species									
		'Mystery' Gardenia					'Natchez' Crape Myrtle				
		8 Weeks		13 Weeks after treatment			8 Weeks		13 Weeks after treatment		
Treatment	**Concentration (ppm)**	**Height (cm)**	**Width (cm)**	**Shoot length[x] (cm)**	**Internodes per shoot**	**Internode length (cm)**	**Height (cm)**	**Width (cm)**	**Shoot length (cm)**	**Internodes per shoot**	
Control	0	32.5	39.4	51.0	13.6	3.1	73.2	97.3	91.6	26.6	
Cutless W	500	31.4	30.2	43.8	11.2	3.0	61.8	101.1	83.6	23.8	
Cutless W	750	22.2	28.4	28.0	9.4	2.5	54.0	91.7	71.0	23.2	
Cutless W	1000	28.6	30.6	36.0	10.8	2.3	52.8	92.5	71.6	19.8	
Cutless W	1250	28.2	33.2	39.8	10.8	2.9	53.6	97.3	73.0	18.2	
Cutless W	1500	24.6	30.6	32.6	7.7	2.3	50.2	98.7	72.6	23.0	
Regression significance[z]		L***	Q*	Q**	L**	L*	L***	NS	Q*	L*	
Atrimmec	4800	33.4	37.5	46.4	12.8	3.2	73.4	96.2	80.8	25.2	
Trim-Cut	1600	36.0	37.0	47.0	14.0	3.0	68.4	103.9	89.8	25.6	
LSD[y]		5.0	7.0	7.4	2.9	0.7	11.6	12.9	11.1	6.1	

[z]Significance of regression analysis at P ≤ 0.05 (*), .01 (**), .001 (***). L = linear; Q = quadratic; NS = not significant; control included in regression.
[y]Mean separation within columns by LSD, P = 0.05.
[x]Mean length of 2 longest shoots per plant.

est suppression occurring at 750 ppm (Table 3). The reduced shoot elongation was due to shorter and fewer internodes per shoot. Neither Atrimmec (dikegulac) nor Trim-cut (mefluidide) affected growth of these gardenias.

Crape myrtles had a linear decrease in plant height with increasing Cutless (flurprimidol) rates at 8 weeks post-treatment, although actual differences at rates above 750 ppm were minimal (Table 3). A quadratic reduction in shoot length 13 weeks after treatment confirms rates of about 750 ppm for optimum growth suppression. There was a slight decrease in growth suppression from 8 to 13 weeks after treatment with plant heights at 8 weeks and shoot lengths at 13 weeks being 74% and 78% of the controls respectively. The Atrimmec (dikegulac) and Trim-cut (mefluidide) treatments had no effect on the crape myrtles.

All Cutless (flurprimidol) treatments (500 ppm and above) may have excessively reduced photinia growth in this experiment. At 13 weeks, the Cutless (flurprimidol)-treated photinia were half the height of the controls (Table 4). Growth suppression was due to both fewer and shorter internodes. In experiment 1, treatments of 600-1000 ppm did not seem excessive; however, these were larger plants in #3 containers (vs. #1 for Expt. 2). Laiche (5), working with photinia in 5.7 liter (6 qt) containers, found optimum Cutless (flurprimidol) spray rates to be less than 500 ppm. Apparently plant size has some influence on rate response. Atrimmec (dikegulac) reduced photinia shoot elongation at 8 weeks post-treatment but not at 13 weeks. Atrimmec (dikegulac) also increased the number of new shoots, producing a fuller-appearing plant.

None of the treatments affected the growth of nandina (data not shown).

(*Ed. note*: This paper reports the results of research only and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.)

Table 4. **Growth response of *Photinia* x *fraseri* to foliar application of Cutless, Atrimmec, or Trim-Cut, Experiment 2.**

		8 Weeks		13 Weeks after treatment			
Treatment	Concentration (ppm)	Height (cm)	Width (cm)	Height (cm)	Width (cm)	Internodes per shoot	Internode length (cm)
Control	0	45.4	43.0	60.4	50.7	22.4	1.7
Cutless W	500	29.4	30.8	33.4	36.9	13.0	0.7
Cutless W	750	27.8	30.3	30.2	33.6	13.6	0.7
Cutless W	1000	26.8	29.4	28.4	32.8	15.6	0.6
Cutless W	1250	29.4	27.0	30.6	32.2	12.8	0.7
Cutless W	1500	28.4	27.8	30.6	30.2	12.6	0.5
Regression significance[z]		C*	Q**	Q***	Q**	L**	C***
Atrimmec	4800	37.4	40.7	55.4	54.1	21.4	1.4
Trim-Cut	1600	46.8	42.7	63.8	55.0	24.6	1.7
LSD[y]		5.3	6.0	7.2	6.6	5.5	0.2

[z]Significance of regression analysis at P ≤ 0.05 (*), .01 (**), .001 (***). L = linear; Q = quadratic; C = cubic; control included in regression.
[y]Mean separation within columns by LSD, P = 0.05.

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Validity of Screening for Foliage Cold Hardiness in the Laboratory[1]

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Abstract

Thirty-five broadleaf evergreens which are evergreen in USDA cold hardiness Zone 7 were screened using leaf discs in the laboratory for Zone 6 (–20C) temperatures. Field data were collected from the plants in the field after two consecutive nights with lows of –20C. Correlations between lab and field scores were high, demonstrating the usefulness of leaf discs in initially screening broadleaf evergreens for evergreeness. The method allows for a more thorough sampling of a taxon and may therefore give better results than using a limited number of larger leaf samples, such as whole leaves. A number of the tested taxa should prove evergreen in Zone 6, including: *Camellia oleifera* Abel 'Lu Shan Snow', *Viburnum* L. Arrowwood 'Conoy', *Viburnum rhytidophyllum* Hemsl. 'Cree', and certain selections of *Pyracantha* M.J. Roem, *Illicium anisatum* L., *Quercus acuta* Thunb., *Quercus myrsinifolia* Blume and *Daphniphyllum macropodum* var. *humile* Miq.

Index words: cold hardiness, broadleaf evergreens, laboratory-field correlations.

Species used in this study: *Camellia japonica* L., *Camellia oliefera* Abel 'Lu Shan Snow', *Daphniphyllum macropodum* Miq., *Gardenia* Ellis. 'Klines Hardy', *Gardenia* 'Daisy', *Illicium anisatum* L., *Illicium mexicana* A.C. Sm., *Itea oldhami* Schneid., *Lithocarpus henryi* Rehd. & E. H. Wils., *Pyracantha* M.J. Roem., *Quercus acuta* Thunb., *Quercus glauca* Thunb., *Quercus laurifolia* Michx., *Quercus myrsinifolia* Blume, *Quercus salicina* Blume, *Raphiolepis indica* (L.) Lindl., *Raphiolepis umbellata* (Thunb.) Mak., *Sycopsis sinensis* D. Oliver., *Viburnum* L. Arrowwood 'Conoy', *Viburnum rhytidophyllum* Hemsl. 'Cree', *Viburnum* 'Eskimo'.

Significance to the Nursery Industry

A broadleaf evergreen cultivar may survive in a certain cold hardiness zone but may not be evergreen. As new broadleaf evergreens become available it is important that the grower know in which zones they can expect the plant to remain evergreen. The simple procedure described has proven to be a reliable tool for predicting whether a plant will remain evergreen in a particular zone. An examination of 35 taxa using this procedure found a number of plants which should be suitable for Zone 6 conditions. These include: *Viburnum* 'Conoy', *Viburnum rhytidophyllum* 'Cree', two pyracantha selections, *Camellia* 'Lu Shan Snow', an *Illicium anisatum* selection, selections of *Quercus acuta* and *Q. myrsinifolia* and a *Daphniphyllum macropodum* var. *humile* selection.

Introduction

Broadleaf evergreens are important landscape plants, especially in the southern cold hardy zones (Zone 7b and warmer (11)). The number of broadleaf evergreens suitable for use in Zone 7 is limited, and the choices become more limited in the colder hardiness zones (Zone 6 and below). Users in the colder climates would welcome additional broadleaf evergreen choices for their gardens. As new broadleaf evergreens come onto the market through breeding and exploration efforts, foliage cold hardiness needs to be quickly and accurately determined so growers will know whether a given plant will be evergreen in a given hardiness zone. Laboratory tests have been relatively successful in determining relative hardiness of stems and leaves and may provide a quick and easy method for initial evaluation of plants (2, 4, 5, 7).

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