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Growth Response of 13 Container-Grown Landscape Plants to Uniconazole[1]

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Abstract

Uniconazole, an experimental plant growth regulator, was applied as a foliar spray and a medium drench to 13 and 7 species, resp. Shoot dry weight was determined at 60, 90, and 120 days after treatment. Sixty days after treatment, shoot dry weight of no species was affected by uniconazole. At 90 and 120 days, shoot dry weight of all species, except golden privet (*Ligustrum* × *vicaryi*), Russian-olive (*Elaeagnus angustifolia*), and waxleaf privet (*Ligustrum lucidum*), decreased with increasing rates of uniconazole, regardless of method of application. Degree of growth reduction varied by species, rate, and method of application. For most species, uniconazole was effective in suppressing growth for 120 days. Generally greater reduction of shoot growth resulted from drench application compared to foliar application.

Index words: growth retardant, XE-1019, Sumagic
Growth regulator used in this study: uniconazole, (E)-(p-chlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol.
Species used in this study: glossy abelia (*Abelia* × *grandiflora*); Japanese barberry 'Atropurpurea' (*Berberis thunbergii* 'Atropurpurea'); forsythia 'Spectabilis' (*Forsythia* × *intermedia* 'Spectabilis'); Carolina yellow jessamine (*Gelsemium sempervirens*); winter jasmine (*Jasminum nudiflorum*); crapemyrtle 'Natchez' (*Lagerstroemia indica* 'Natchez'); waxleaf privet (*Ligustrum lucidum*); golden privet (*Ligustrum* × *vicaryi*); pyracantha 'Lalandei' (*Pyracantha coccinea* 'Lalandei'); azalea 'Delaware Valley White' (*Rhododendron mucronatum* 'Delaware Valley White'); azalea 'Formosa' (*Rhododendron* × 'Formosa'); azalea 'Gilbraltar' (*Rhododendron* × 'Gilbraltar'); and Russian-olive (*Elaeagnus angustifolia*).

Significance to the Nursery Industry

Uniconazole is not effective on all species. In this study, uniconazole produced acceptable growth reductions in 10 out of 13 species. The recommended rate and method of application will have to be based on species. Growers should avoid using general recommendations across a broad range of species. This could potentially produce unacceptable results. Uniconazole activity is prolonged with no proven method of reversibility, other than time. However, longevity also appears to be species related. More information is needed on species response and longevity before uniconazole should be used in the industry.

Introduction

Extensive pruning is required for many nursery crops to maintain compact form. Chemical control of vegetative growth is an appealing alternative to hand and mechanical pruning, both labor intensive. At low concentrations, uniconazole, an experimental growth retardant, has successfully suppressed growth of bedding plants (2), hydrangea (1), and several woody landscape plants (3, 4, 5). The objective of this study was to determine the effects of uniconazole concentration and method of application (foliar and drench) on vegetative growth of selected landscape plants throughout a growing season.

Materials and Methods

The experiment, a randomized complete block design with 12 replications, was conducted at the Mountain Horticultural Crops Experiment Station [35°26'N, 82°34'W. elevation = 631 m (2051 ft)], Fletcher, NC. Four replicates were randomly chosen to be harvested at each of 3 predetermined times during the study.

Uniform rooted cuttings of all species, excluding Russian-olive which were seedlings, were potted into 3.8 l (#1) containers on April 4, 1988. Growth medium consisted of milled pine bark amended with 3.0 kg/m^3 (5 lbs/yd^3) dolomitic limestone and 0.89 kg/m^3 (1.5 lbs/yd^3) Micromax. Fourteen grams (0.5 oz) of Osmocote 18N-2.6P-10K (18-6-12) was surface applied to each container on April 26, 1988. Soluble salts and pH were monitored weekly utilizing procedures of Wright (6). When soluble salts level dropped below 0.25 mMhos on July 13, 1988, Osmocote 18N-2.6P-10K (18-6-12) was reapplied at the above mentioned rate. Plants received 1.3 cm (0.5 in) of water daily via overhead irrigation. On May 23, 1988 all plants were pruned to 10 cm (4 in).

Uniconazole rates and method of application were based on manufacturers recommendations. Twelve to 15 ml (0.4 to 0.5 oz) of six rates of uniconazole were applied to the foliage of each species with a hand-held sprayer on June 6, 1988 between 6:30 and 8:30 AM at the following rates: glossy abelia: 0, 100, 150, 200, 250, and 300 ppm; Japanese barberry 'Atropurpurea': 0, 100, 125, 150, 175, and 200 ppm; forsythia 'Spectabilis': 0, 50, 90, 130, 170, and 210 ppm; Carolina yellow jessamine: 0, 75, 125, 175, 225, and 275 ppm; winter jasmine: 0, 75, 125, 175, 225, and 275 ppm; crapemyrtle 'Natchez': 0, 25, 75, 125, 175, 225 ppm; waxleaf privet: 0, 25, 40, 55, 70, and 85 ppm; golden privet: 0, 25, 75, 125, 175, and 225 ppm; pyracantha 'Lalandei': 0, 25, 45, 65, 85, and 105 ppm; azalea 'Delaware Valley White': 0, 2.5, 7.5, 15, 20, and 25 ppm; azalea 'Formosa': 0, 5, 20, 60, 80, and 100 ppm; azalea 'Gilbraltar': 0, 5, 20, 60, 80, and 100 ppm; and Russian-olive: 0, 50, 125,

[1]Received for publication October 23, 1989; in revised form May 7, 1990. Technical assistance of William Reece, Everett Whitman, Shari Eakes, and Janet Cole, and financial assistance of Valent USA Corporation is gratefully acknowledged.

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Table 1. Effect of uniconazole on shoot dry weight of glossy abelia, azalea 'Delaware Valley White', azalea 'Formosa', azalea 'Gilbraltar', and Japanese barberry 'Atropurpurea' 120 days after foliar application.

Glossy abelia		'Atropurpurea' Japanese barberry		'Delaware Valley White' azalea		'Formosa' azalea		'Gilbraltar' azalea	
rate (ppm)	Dry wt (g)	rate (ppm)	Dry wt (g)	rate (ppm)	Dry wt (g)	rate (ppm)	Dry wt (g)	rate (ppm)	Dry wt (g)
0	84.8	0	70.3	0	79.0	0	65.2	0	39.2
100	57.5	100	62.5	2.5	76.1	5	63.6	5	32.7
150	54.9	125	62.2	7.5	71.8	20	60.2	20	33.9
200	54.5	150	62.8	15.0	70.0	60	50.4	60	30.8
250	48.4	175	53.9	20.0	64.4	80	51.2	80	30.8
300	46.5	200	59.0	25.0	65.5	100	51.1	100	31.2
Significance[z]									
L[y]	**		*		**		**		**
Q	*		NS		NS		*		**

[z]NS, *, **Nonsignificant or significant at $p \leq 0.05$ or $p \leq 0.01$, respectively.
[y]L = linear, Q = quadratic.

250, 375, and 500 ppm. The growth medium was covered during application to prevent the spray from contacting the medium surface.

One hundred ml (3.4 oz) per container of an aqueous drench application of 0, 1, 3, or 5 mg a.i. was applied on June 6, 1988 between 8:30 and 9:30 AM to the following species: forsythia 'Spectabilis', Carolina yellow jessamine, winter jasmine, crapemyrtle 'Natchez', golden privet, pyracantha 'Lalandei', and Russian-olive. All species were irrigated 4 hr before foliar application and 24 hr after the drench application.

Height and width (width measured in two perpendicular directions) were measured at treatment application and every 30 days thereafter. A growth index was calculated for each species using the following formula: [height + ((width A + width B) / 2) / 2]. Shoots (aerial tissue) of four plants of each species were harvested at 60, 90, and 120 days after uniconazole application (also referred to as harvest 1, 2, and 3, resp). Tissue was dried at 70°C (160°F) for 96 hr and weighed. Percent reduction in shoot dry weight, compared to a nontreated control, was calculated using the equation: [(control shoot dry weight − treated shoot dry weight) / control shoot dry weight] × 100, with 0% = no reduction in shoot dry weight. Plants were evaluated 10 days after application and at each harvest for phytotoxicity on a scale of 1 to 5, with 1 = no visible foliar injury and 5 = severe foliar injury. Data were analyzed by analysis of variance and regression analysis (SAS Institute, Cary, NC).

Results and Discussion

Growth index and shoot dry weight were highly correlated ($r \geq 0.89$, $p \leq 0.01$) at 60, 90, and 120 days after uniconazole application so only data for shoot dry weight are presented. Method of application (foliar and drench) had a significant ($p \leq 0.05$) effect on plant response. Thus, all data are presented by method of application.

No phytotoxicity occurred on any species, except golden privet. Golden privet exhibited foliar necrosis throughout the growing season. However, the injury was not consistent with higher rates of foliar or drench applications.

At harvest 1, uniconazole had no effect on the shoot dry weight of any of the species (data not presented). Results were similar for each species at 90 and 120 days after treatment. Therefore, only data from harvest 3 are presented.

Table 2. Effect of uniconazole on shoot dry weight of forsythia 'Spectabilis', Carolina yellow jessamine, winter jasmine, crapemyrtle 'Natchez', and pyracantha 'Lalandei' 120 days after foliar or drench application.

'Spectabilis' forsythia				'Natchez' crapemyrtle				'Lalandei' pyracantha			
Foliar rate (ppm)	Dry wt (g)	Drench rate (mg a.i.)	Dry wt (g)	Foliar rate (ppm)	Dry wt (g)	Drench rate (mg a.i.)	Dry wt (g)	Foliar rate (ppm)	Dry wt (g)	Drench rate (mg a.i.)	Dry wt (g)
0	70.4	0	68.8	0	106.5	0	107.2	0	79.7	0	81.2
50	52.5	1	43.8	25	100.5	1	86.0	25	75.6	1	62.4
90	47.2	3	41.1	75	99.5	3	89.6	45	75.1	3	57.6
130	51.0	5	35.7	125	85.6	5	79.2	65	79.2	5	52.8
170	58.9			175	87.6			85	72.5		
210	45.5			225	86.4			105	70.9		
Significance[z]											
L[y]	**		**		*		**		*		**
Q	*		*		NS		NS		NS		*

[z]NS, *, **Nonsignificant or significant at $p \leq 0.05$ or $p \leq 0.01$, respectively.
[y]L = linear, Q = quadratic.

Table 3. Effect of uniconazole on shoot dry weight of Carolina yellow jessamine and winter jasmine 120 days after drench application.

Carolina yellow jessamine		Winter jasmine	
Drench rate (mg a.i.)	Dry wt (g)	Drench rate (mg a.i.)	Dry wt (g)
0	62.2	0	63.9
1	53.3	1	54.8
3	49.9	3	28.5
5	48.6	5	27.9
Significance[z]			
L[y]	**		**
Q	NS		*

[z]NS, *, **Nonsignificant or significant at $p \leq 0.05$ or $p \leq 0.01$, respectively.

[y]L = linear, Q = quadratic.

Table 4. Percent reduction in shoot dry weight (%)[z], compared to nontreated controls, 120 days after foliar or drench application of uniconazole[y]

	Application method	
Species	Foliar	Drench
glossy abelia	38	NA[x]
Japanese barberry 'Atropurpurea'	15	NA
azalea 'Delaware Valley White'	12	NA
azalea 'Formosa'	16	NA
azalea 'Gilbraltar'	16	NA
forsythia 'Spectabilis'	31	43
crapemyrtle 'Natchez'	13	20
pyracantha 'Lalandei'	7	28
Carolina yellow jessamine	0	19
winter jasmine	17	41

[z]Averaged over all treatment rates, except 0, within each species and method of application.

[y]Percent reduction in shoot dry weight was calculated using the equation: [(control shoot dry weight − treated shoot dry weight) / control shoot dry weight] × 100, with 0% = no reduction in shoot dry weight.

[x]NA = no drench treatment applied.

Shoot dry weight of all species, except Carolina yellow jessamine (foliar only), golden privet, Russian-olive, and waxleaf privet, decreased with increasing rates of uniconazole, regardless of method of application (Tables 1, 2, and 3). This is similar to results reported for forsythia 'Spectabilis' (5), pyracantha 'Wonderberry' (*Pyracantha koidzumi* 'Wonderberry'), and Fraser photinia (*Photinia* × *fraseri*) (3). Shoot dry weight of golden privet and Russian-olive were unaffected by foliar or drench applications; and waxleaf privet and Carolina yellow jessamine did not respond to foliar application (data not presented). However, shoot dry weight reduction, averaged over all treatment rates within each species and method of application, compared to a nontreated control, ranged from 7 to 41% depending upon species and method of application (Table 4). In general, drench applications were more effective than foliar sprays.

In addition to the magnitude of growth suppression, the duration of growth suppression is also an important consideration. Eleven species maintained similar percent shoot dry weight reduction between harvests 2 and 3 suggesting uniconazole was still effective after 120 days. Two species, Japanese barberry 'Atropurpurea' and pyracantha 'Lalandei', had significant ($p \leq 0.05$) decreases in percent shoot dry weight between harvests 2 and 3. Japanese barberry 'Atropurpurea' decreased from 50 to 7% reduction in shoot dry weight, compared to a nontreated control; pyracantha 'Lalandei' decreased from 14% to 7% and 47% to 28% for foliar and drench applications, respectively. For these species 120 days may be the limit of effectiveness of uniconazole.

(*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.)

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