Herbicide Tolerance of Selected Ericaceous Species[1]

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Abstract

This study was conducted to determine the tolerance of seven Ericaceous species to 15 herbicide treatments. Treatment response was species dependent. Pre-M (pendimenthalin) at the 2.2 kg/ha (2 lb ai/A) rate reduced top fresh weight of mountain laurel (*Kalmia latifolia*), flame azalea (*Rhododendron calendulaceum*) and Carolina rhododendron (*Rhododendron carolinianum*) while the 4.5 kg/ha (4 lb ai/A) rate affected these 3 species plus drooping leucothoe (*Leucothoe fontanesiana*), sourwood (*Oxydendrum arboreum*), Catawba rhododendron (*Rhododendron catawbiense*) and azalea 'Hinocrimson' (*Rhododendron* 'Hinocrimson'). SWGC (pendimethalin) at 3.4 kg/ha (3 lb ai/A) reduced top fresh weight of sourwood, flame azalea and Carolina rhododendron. Goal (oxyfluorfen) + AG98 reduced fresh weight of every species except Carolina rhododendron. Snapshot DF (isoxaben + oryzalin) at 3.4 kg/ha (3 lb ai/A) reduced top fresh weight of mountain laurel and flame azalea. Mountain laurel showed a reduction in fresh weight for Pennant GR (metolachlor) at the 4.5 kg/ha (4 lb ai/A) rate. At the 2.2 kg/ha (2 lb ai/A) rate of Ronstar WP (oxadiazon), reduced Catawba rhododendron top fresh weight, however, Catawba rhododendron was not affected by the 4.5 kg/ha (4 lb ai/A) rate. The Poast (sethoxydim) treatment at 0.6 kg/ha (0.5 lb ai/A) + crop oil concentrate reduced fresh weight of flame azalea. SWGC at 3.4 kg/ha (3 lb ai/A), OH2 (oxyfluorfen + pendimethalin) at 3.4 kg/ha (3.0 lb ai/A), Gallery (isoxaben) at 1.1 kg/ha (1.0 lb ai/A), Snapshot GR (isoxaben + trifluralin) at 4.0 kg/ha (3.75 lb ai/A), Derby (metolachlor + simazine) at 5.7 kg/ha (5.0 lb ai/A), and the ready-to-use formulation of sethoxydim did not reduce top fresh weight of any of the seven species tested.

Index words: Ericaceae, fresh weight

Species used in this study: mountain laurel (*Kalmia latifolia* L.); drooping leucothoe [*Leucothoe fontanesiana* (Steud.) Sleum]; sourwood (*Oxydendrum arboreum* DC); flame azalea (*Rhododendron calendulaceum* Torr.); Carolina rhododendron (*Rhododendron carolinianum* Rehd.); Catawba rhododendron (*Rhododendron catawbiense* Michx.); 'Hinocrimson' azalea (*Rhododendron obtusum* (Lindl.) Planch cv. 'Hinocrimson,' an old Kurume hybrid) (8).

Chemicals used in this study: Herbicides: Pre-M 60 WDG and Southern Weed Grass Control (SWGC, 2.45 GR) (pendimethalin) N-(1-ethylpropyl)-3,4dimethyl-2,6-dinitrobenzenamine; Goal (oxyfluorfen) 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluromethyl)benzene; Ornamental Herbicide 2 (OH2), (oxyfluorfen + pendimethalin), 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene + N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine; Gallery (isoxaben) N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide and isomers; Snapshot 2.5 GR (isoxaben + trifluralin) N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide + 2,6-dinitro-N, N-dipropyl-4-(trifluoromethyl) benzenamine; Snapshot 80 DF (isoxaben + oryzalin) N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide + 4-(dipropylamino)-3,5-dinitrobenzenesulfonamide; Pennant (metolachlor) 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide; Derby (metolachlor + simazine) 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide + 6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine; Ronstar (oxadiazon) 3-[2, 4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one; Poast (sethoxydim) 2-[1-(ethoxyimino)butyl]-5-[2(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one; Ready-to-use (RTU) formulation of sethoxydim from BASF (BAS 56216H).

Adjuvants: Surfactant, AG-98, Rohm & Haas, Philadelphia, Pennsylvania 19105; Crop Oil (COC), Agri-Dex, Helena Chemical Co., Inman, SC 29615.

Significance to the Nursery Industry.

Ericaceous plants have become popular for both home and commercial landscape use and are grown extensively by nurserymen. Weed control in container production is essential, yet there are few herbicides labeled for Ericaceous species. This study provides data for seven Ericaceous species.

Introduction

Container production of landscape plants represents over half of all landscape plants sold in the United States (2). Weed control in container-grown plants is one of the principal cultural problems. Weed competition for light and nutrients can severely stunt the growth of ornamental plants thereby reducing the value to the grower (7). Effective weed control can increase growth of the ornamental plant by 50% or more. Manual weed control is expensive, requiring up to 1,542 manhours/ha/year (624 manhours/A/year) to remove weeds from one hectare (2.5 acre) of 3.8 l (#1) containers (14). In a 1987 survey of 32 container nurseries, an average of 262 hours/ha (106 hours/A) were spent on weed control with costs ranging from $608–1401/ha ($246–567/A) (10).

The species evaluated in this study are widely grown and are of increasing popularity in the landscaping and nursery trade. Of the seven species, only azalea 'Hinocrimson' has been widely evaluated for herbicide tolerance (3, 4, 5, 6, 9, 11, 15). Mountain laurel and Catawba rhododendron have been evaluated on a limited basis (12, 13). Ahrens (1) reported reduced vigor for both of these species when treated with asulam (Asulox) and glyphosate. References regarding weed control and phytotoxicity for the other four species

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(drooping leucothoe, sourwood, flame azalea and Carolina rhododendron) were not located. Therefore, the objective of this study was to evaluate the use of various herbicides on phytotoxicity of several species of the Ericaceae (heath family).

Materials and Methods

This experiment, a randomized complete block design with five replications, was conducted on a gravel pad at the Mountain Horticultural Crops Experiment Station [35°26'N, 82°34'W, elevation 631 m (2051 ft.)], Fletcher, North Carolina in 1988 and was repeated in 1989.

Mountain laurel, drooping leucothoe, sourwood, flame azalea, Carolina rhododendron, Catawba rhododendron, and azalea 'Hinocrimson' were potted in 3.8 l (#1) black plastic containers on April 29, 1988 and April 27, 1989. Planting medium consisted of milled pine bark that was amended with 3.0 kg/m^3 (5 lbs/yd^3) dolomitic limestone and 0.89 kg/m^3 (1.5 lbs/yd^3) micronutrient mix (Micromax, Grace-Sierra Chemical Co., Militapas, CA). Nine grams (0.3 oz) of 18N-2.6P-10K (18-6-12) Osmocote (Grace-Sierra Chemical Co.) fertilizer was surface applied to each container on May 5, 1988 and May 8, 1989. Soluble salts were monitored biweekly utilizing procedures of Wright (16). When the soluble salts level dropped below 0.25 mMhos on June 26, 1988 and June 30, 1989, Osmocote was reapplied at the above mentioned rate. Plants received 1.3 cm (1/2 in) of water daily by overhead irrigation.

Herbicide treatments were applied May 11, July 7, and September 7, 1988 and May 12, July 13, and September, 1989. Herbicide treatments included: Pre-M WDG, 2.25 and 4.5 kg/ha (2 and 4 lbs ai/A); Goal 1.6E, 0.45 kg/ha (0.4 lb ai/A); SWGC 2.45 GR, 3.4 kg/ha (3 lbs ai/A); OH2 3G, 3.4 kg/ha (3 lbs ai/A); Gallery 75DF, 1.1 kg/ha (1.0 lb ai/A); Snapshot 2.5 GR, 4.1 kg/ha (3.75 lbs ai/A); Snapshot 80 DF, 3.4 kg/ha (3 lbs ai/A); Pennant 5 GR, 4.5 kg/ha (4 lbs ai/A); Derby 5 GR, 5.6 kg/ha (5 lbs ai/A); Pennant 8 EC, 4.5 kg/ha (4 lbs ai/A); Ronstar 50 WP, 2.2 and 4.5 kg/ha (2 and 4 lbs ai/A); and Poast 1.5 E, 0.6 kg/ha (0.5 lb ai/A). Granular herbicides were applied via a shaker jar. The remaining herbicides were applied via a CO_2 backpack sprayer equipped with 49 × 49 whirljet nozzles delivering 168 l/ha (18 gal/A) at 20 psi (138 kPa).

All plants were rated for reduction in salability prior to harvest. Salability reduction was rated on a scale of 0 to 100 with 0 = no reduction in plant quality and 100 = dead plants. Top fresh weight (aerial tissue) was taken on October 11, 1988, and October 15, 1989. Percent reduction in top fresh weight, compared to an untreated check, was calculated using the equation: [(check top fresh weight - treated top fresh weight)/check top fresh weight] × 100, with 0% = no top fresh weight loss and 100% = plant mortality. Data were subjected to an analysis of variance, where treatment effects were found, means were separated by the LSD test (SAS Institute, Cary, NC).

Results and Discussion

There were no significant differences between the 1988 and 1989 experiments. Thus, data were combined. Correlations between top fresh weight and salability for all species ranged from 0.56 to 0.85 and were significant for all species ($p \leq 0.05$). Thus, only data for top fresh weight are presented. Effect of herbicides on top fresh weight was species dependent (Table 1).

Mountain laurel. Top fresh weight was reduced by Pre-M 2.25 and 4.5 kg/ha (2 and 4 lb/A), Goal, Snapshot DF, Pennant GR, Snapshot GR, Ronstar at 2.2 kg/ha (2 lb/A) and 4.4 kg/ha (4.0 lb/A) and the RTU formulation of sethoxydim (Table 1).

Drooping leucothoe. All herbicides, except SWGC and Poast, reduced top fresh weight (Table 1). Significant reductions in fresh weight ranged from 34 to 78% of check.

Table 1. Percent reduction in top fresh weight of ericaceous shrubs, compared to an untreated check.[z]

Herbicide	Formulation	Rate kg/ha	Rate (lb/A)	% Reduction Mt. laurel	Drooping leucothoe	Sourwood	Flame azalea	Carolina rhododendron	Catawba rhododendron	'Hinocrimson' Azalea
Pre-M	WDG 60%	2.2	2.0	82*	57*	79*	93*	53*	23	28
Pre-M	WDG 60%	4.5	4.0	97*	78*	83*	79*	82*	33	51*
Goal + AG98	EC 1.6	0.5	0.4	57*	60*	72*	94*	74*	38	76*
SWGC	GR 2.45	3.4	3.0	24	26	44*	58*	43*	+27	+31
OH2	GR 3%	3.4	3.0	28	34*	53*	66*	23	+7	12
Gallery	DF 75%	1.1	1.0	28	36*	64*	52*	66*	20	24
Snapshot	GR 2.5%	4.1	3.75	40*	44*	27	76*	49*	7	+7
Snapshot	DF 80%	3.4	3.0	90*	72*	59*	34	64*	+6	66*
Pennant	GR 5%	4.5	4.0	36	37*	61*	45*	56*	4	12
Derby	GR 5%	5.6	5.0	23	35*	28	61*	73*	+7	26
Pennant	EC 8.0	4.5	4.0	70*	53*	77*	99*	74*	30	+6
Ronstar	WP 50%	2.2	2.0	65*	44*	83*	77*	68*	46*	42
Ronstar	WP 50%	4.5	4.0	65*	53*	90*	84*	74*	+2	48*
Poast + COC	EC 1.53	0.6	0.5	+10	25	31*	70*	52*	8	3
Sethoxydim formulation	RTU			65*	47*	38*	66*	56*	37	2
Check				0	0	0	0	0	0	0
LSD (0.05)				36	29	30	42	34	38	44

*Indicates mean is significantly different from the check using LSD comparison.

[z]Percent reduction = [(check top fresh weight - treated top fresh weight) / check top fresh weight] × 100. 0 = no top fresh weight loss compared to plants receiving no herbicide treatment; 100 = plant mortality.

Sourwood. Significant reductions in top fresh weight, ranging from 31 to 90%, were found for every treatment except Derby and Snapshot GR (Table 1).

Flame azalea. All herbicides reduced top fresh weight, except Snapshot DF (Table 1).

Carolina rhododendron. Every treatment, except OH2, reduced top fresh weight (Table 1).

Catawba rhododendron. Kuhns and Haramaki (12) and Kuhns et al. (13) noted that oryzalin and Poast did not injure this species. Data herein support these findings (Table 1). However, the RTU formulation of sethoxydim, Goal and Ronstar WP at the 2.25 kg/ha (2 lb/A) reduced top fresh weight.

'Hinocrimson' azalea. Pre-M at the 4.5 kg/ha (4 lb/A) rate, Goal, Ronstar at the 4.5 kg/ha (4 lb/A) rate, and Snapshot DF reduced top fresh weight 51, 76, 48, and 66%, respectively. Similarly, Singh et al. (15) and Kuhns and Haramaki (12) reported that Goal was phytotoxic to 'Hinocrimson.' In addition, Singh et al. (15) reported that Goal and Ronstar restricted root growth. However, Creager (5) reported no visible plant injury and Beste and Frank (3) reported no phytotoxicity or differences in growth when compared to the control for both Goal and Ronstar. Poast and RTU sethoxydim did not affect top fresh weight.

Of the 15 herbicides used in this study, none could be applied to all seven species. Flame azalea, drooping leucothoe, sourwood and Carolina rhododendron only exhibited tolerance to one, two, two and one herbicides, respectively, of the 15 herbicides examined. The choice of herbicides for these species appears to be limited. In contrast, mountain laurel and Catawba rhododendron exhibited tolerance to six and 12 herbicides, respectively, of the 15 herbicides tested.

(*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 of federal authorities.)

Literature Cited

1. Ahrens, J.F. 1975. Selectivity of glyphosate and asulam in ornamental plantings. Weed Sci. Soc. Amer., Abstr. 40:16–17.

2. Beattie, D.J. (Ed.). 1986. Principles, practices, and comparative costs of overwintering container-grown landscape plants. Southern Cooperative Series Bull. 313, Pennsylvania Agric. Expt. Sta., University Park.

3. Beste, C.E. and J.R. Frank. 1986. Sequential herbicide applications for weed control in azaleas. HortScience 21:449–451.

4. Coffman, C.B., J.R. Frank and W.A. Gentner. 1984. Sethoxydim (Poast) and oxyfluorfen (Goal) efficacy and tolerance by landscape plants. J. Environ. Hort. 2:120–122.

5. Creager, R.A. 1982. Evaluation of oxadiazon and oxyfluorfen for weed control in container-grown ornamentals. HortScience 17:40–42.

6. Derr, J.F. and B.L. Appleton. 1989. Phytotoxicity and yellow nutsedge control in azalea and liriope with Basagran (bentazon). J. Environ. Hort. 7:91–94.

7. Elmore, C.L. 1973. Weed Pollution. Proc. Intern. Plant Prop. Soc. 23:95–100.

8. Fantz, P.R., D.M. Benson, and W.A. Skroch. 1989. 'Rachel' and 'Jan Cochran' Carla azaleas. HortScience 24:717–718.

9. Frank, J.R., C.R. Krause and C.E. Beste. 1987. Effects of three herbicides on the foliage of kurume azaleas. J. Environ. Hort. 5:55–62.

10. Gilliam, C.H., W.J. Foster, J.L. Adrain and R.L. Shumack. 1990. A survey of weed control costs and strategies in container production nurseries. J. Environ. Hort. 8:133–135.

11. Kalmowitz, K. and T. Whitwell. 1988. Comparison of Ronstar formulations for efficacy and phytotoxicity in container grown landscape plants. J. Environ. Hort. 6:77–80.

12. Kuhns, L.J. and C. Haramaki. 1984. An evaluation of 5 herbicides applied over liners representing 8 genera of ornamental plants. Northeastern Weed Sci. Soc. Proc. 34:340–345.

13. Kuhns, L.J., G. Twerdok, and C. Haramaki. 1984. Screening woody ornamentals for tolerance of fluazifop-butyl and sethoxydim. Northeastern Weed Sci. Soc. Proc. 38:254–255.

14. Padgett, J.H. and T.L. Frazier. 1962. The relationship between costs and pruning of woody ornamentals. Ga. Agric. Expt. Sta. Bul. N.S. 100.

15. Singh, M., N.C. Glaze and S.C. Phatak. 1981. Herbicidal response of container-grown Rhododendron species. HortScience 16:213–215.

16. Wright, R.D. 1986. The pour-through nutrient extraction procedure. HortScience 21:227–229.