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Growth Inhibition of Ericaceous Plants from Metolachlor[1]

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Abstract

Yellow nutsedge (*Cyperus esculentus* L.) is a major weed problem in many perennial woody crops. Dual 8E[4] (metolachlor) at 4.5, 6.7, 9.0 and 13.5 kg/ha (4, 6, 8 and 12 lb/A) was evaluated in the field for 4 years to determine phytotoxicity to 11 varieties of azaleas. Also evaluated were Ericaceous species including coast leucothoe, compact Japanese andromeda, and *Rhododendron* × 'PJM'. Fall or spring applications of metolachlor at rates up to 13.5 kg/ha (12.0 lb/A) caused no injury to the established azaleas 'Delaware Valley White', 'Hershey Red' and 'Hinocrimson'. Some temporary injury occurred to newly planted 'Hinocrimson' azaleas treated with metolachlor at 6.7 kg/ha (6.0 lb/A). A July application at this same rate caused some temporary injury to established 'Delaware Valley White', 'Double Pink', 'Hershey Red', 'Hot Shot', 'Karen', 'Lady Robin', 'Rosebud' and 'Tradition' azaleas and 'Coast lecothoe' and 'PJM' rhododendron. No reduction in crop quality or size was observed with any species at time of crop harvest.

Index words: Dual 8E, Pennant, herbicide, *Cyperus esculentus* L., azalea, leucothoe, pieris, rhododendron, nursery crops

Species used in this study: *Rhododendron* × 'Delaware Valley White'; *Rhododendron* × 'Double Pink'; *Rhododendron* × 'Hershey Red'; *Rhododendron* × 'Hinocrimson'; *Rhododendron* × 'Hot Shot'; *Rhododendron* × 'Karen'; *Rhododendron* × 'Lady Robin'; *Rhododendron* × 'Pleasant White'; *Rhododendron* × 'Renee Michelle'; *Rhododendron* × 'Rosebud'; *Rhododendron* × 'Tradition'; coast leucothoe (*Leucothoe axillaris* [Lam.] D. Don.); compact Japanese andromeda, *Pieris japonica* 'compacta' [Thunb.] D. Don ex G. Don, 'PJM' rhododendon (*Rhododendron* × 'PJM').

Herbicides used in this study: Dual 8E, (metolachlor), 2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide]; Ronstar 2G, (oxadiazon) [3[2,4-dichloro-5-(1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one].

Significance to the Nursery Industry

Yellow nutsedge is poorly controlled by many herbicides now registered for use in nursery stock. Metolachlor at 4.5 kg/ha (4 lb/A) controls yellow nutsedge without significant injury to many varieties of azaleas and other Ericaceous plants including coast leucothoe, compact Japanese andromeda, and 'PJM' rhododendron. Metolachlor (Dual 8E) applied in spring or fall at rates of 6.7 kg/ha (6 lb/A) or higher may cause some early foliar phytotoxicity to newly planted or established azaleas such as 'Delaware Valley White' and 'Hinocrimson'. This treatment may also cause some temporary injury to other varieties of azaleas. No significant phytotoxicity or size reduction was observable on any of the 10 varieties of azaleas or other Ericaceous crops at time of harvest. July applications of metolachlor at 6.7 kg/ha (6.0 lb/A) may cause a slight reduction of size of 'Delaware Valley White' and Coast Leucothoe. Some foliar injury and size reduction will be observed on selected species of Ericaceous plants with applications of metolachlor at 3 times the recommended rate 13.5 kg/ha (12 lb/A).

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[4]Now relabeled as Pennant.

Introduction

Yellow nutsedge is a major weed problem in a variety of woody nursery crops (3, 17) including azaleas (4, 5, 14), euonymus (24), hollies (7), rhododendron (22, 25, 29), and yews (3).

Because tubers are often transported in mulch materials, this weed is also widely found in the landscape (12), in ground covers (13), bedding plants (2, 16), and numerous floral crop growing situations including those for gladiolus (8, 18, 28), ferns (27), cut foliage (27), gypsophila (2), orchids (20), and statice (1).

Many ericaceous nursery plants are grown in the United States for use as landscape plants (3, 10, 14). Most ericaceous plants are shallow rooted and weeds such as yellow nutsedge cause extensive competition for light, moisture, and nutrients (14).

Metolachlor, which is effective for controlling nutsedge in some turf (26) and nursery situations (9, 15), causes some injury to newly planted Korean azaleas (19) and boxleaf Japanese holly (19). Metolachlor has also been reported to be non-injurious on numerous evergreen landscape plants including azaleas (9, 15), cotoneasters (21), hollies (6, 9, 11), rhododendrons (7), and yews (3).

Field experiments were conducted to determine injury to newly planted or established woody ericaceous nursery plants including azaleas, leucothoe, pieris, and rhododendron from applications of Dual 8E (metolachlor).

Materials and Methods

Four field experiments using Dual 8E (metolachlor) to control yellow nutsedge were conducted at a commercial

nursery near Salisbury, MD during 1985, 1986, 1987, and 1988. All plants used in these experiments were rooted from stem cuttings during July 1984, 1985 or 1986. Plants included liners (planted in April 1985) of 'Delaware Valley White', 'Hershey Red', and 'Hinocrimson' azaleas (Azalea I); newly planted 'Delaware Valley White' (Azalea II), and 'Hinocrimson' azaleas (Azalea III). In the fourth experiment the azaleas (planted in April 1987) 'Delaware Valley White', 'Double Pink', 'Hershey Red', 'Hotshot', 'Karen', 'Lady Robin', 'Pleasant White', 'Renee Michelle', 'Rosebud', and 'Tradition' azaleas (Ericaceous Plants I) were used. In this experiment coast leucothoe, 'PJM' rhododendron, and compact Japanese andromeda were also included.

The liners in each experiment were planted in field blocks 1.5 × 80 m (6 × 264 ft) in beds raised 30 cm (12 in) in a Matapeake silt loam (Typic hapludult, fine-silty mixed mesic) modified with 324 m^3/ha (520 yd^3/A) or 390 mt/ha (173 T/A) fresh wt of decomposed pine bark and wood mulch.

A 5 cm (2 in) mulch of pine shavings was applied immediately after planting. The experimental design was a randomized complete block with 3 replications. All metolachor applications were made immediately after planting over the top of the mulch. No irrigation was applied until 24 hours after planting and metolachlor application. In all three experiments, each plot was 1.8 × 3.1 m (6 × 10 ft) and contained 20 plants.

Ronstar 2G (oxadiazon) was applied at 2.2 kg/ha (2.0 lb/A) to all plots in May 1985, 1986, and 1987. Dual 8E was applied to weed-free plots as a topical spray on September 5, 1985 (Azalea I), May 19, 1897 (Azalea II), and May 28, 1987 (Azalea III) at 4.5, 6.7, 9.0 or 13.4 kg/ha (4, 6, 8 or 12 lb/A). All treatments were made using a backpack CO_2 boom sprayer which was calibrated to deliver 215 L/ha (25 gal/A). In the fourth experiment (Ericaceous Plant I) only the 6.7 kg/ha (6.0 lb/A) rate was applied on July 6, 1987 using a power boom sprayer which was calibrated to deliver 344 L/ha (40 gal/A). Wind velocity was < 3.5 km/hr (3 mph) during all applications.

In all experiments 10 random plants in each plot were labeled and the height × width were measured monthly. Observations were also made at the same time to determine phytotoxicity. Phytotoxicity was related to % foliage injury using a rating system of 0 to 10 (0–100%). Plants with a rating of 0 to 3 would be acceptable for sale and those with a rating of 4 to 10 would be considered of poor quality and not marketable. Dead plants were rated as 10 or 100% phytotoxicity.

Weed control ratings and yellow nutsedge counts were made on a regular basis during each experiment. The SAS Categorical Modeling Procedure Catmod was used to analyze the phytotoxicity data. A linear model relating the mean rating to the treatment effects was fit to the data (23). The SAS General Linear Model procedure (GLM) was used to analyze the height × width data. A one way analysis of variance was used to compare the height × width means in the different treatment groups. Significance probabilities were adjusted according to Sidak's inequality with per degree of freedom error rate (23).

Results and Discussion

Weed control. Weed cover during the evaluations of 1985, 1986, 1987 and 1988 did not exceed 5% in any plot. No major amount of yellow nutsedge was observed during these four experiments (data not shown).

Plant quality and marketability. A fall application of metolachlor in 1985 or 1986 at rates up to 13.5 kg/ha (12.0 lb/A) caused no foliar injury to established azalea 'Delaware Valley White', 'Hershey Red', and 'Hinocrimson' (Azalea I) (data not shown). During 1987 injury was observed on foliage of newly planted 'Delaware Valley White' azaleas treated with metolachlor at 13.5 kg/ha (12.0 lb/A) (Azalea II) (Table 1). During 1988 no significant injury occurred with any treatment (Azalea II) (data not shown).

Newly planted 'Hinocrimson' azaleas treated with metolachlor at 6.7 kg/ha (6.0 lb/A) exhibited foliar injury up to 35% during part of 1987 (Azalea III) (Table 1) but no

Table 1. Injury to 'Delaware Valley White' or 'Hinocrimson' azaleas as influenced by a single application of metolachlor (Dual 8E) on May 19 or May 28, 1987, resp.[z,y]

Treatment	Rate (kg/ha)	Rate (lb/A)	Days after treatment - 1987 1/4[x]	37/35	64/62	121/120
			'Delaware Valley White'			
UTC	—	—	1.6[w]	0.7 b	0.2 a	0.1[w]
Metolachlor	4.5	4.0	1.6	0.8 b	0.4 ab	0.2
	6.7	6.0	1.5	0.6 ab	0.2 a	0.2
	9.0	8.0	1.6	0.7 b	0.4 ab	0.2
	13.5	12.0	1.1	0.4 a	0.8 b	0.3
			'Hinocrimson'			
UTC	—	—	0.0 a	0.7 a	0.1 a	0.4
Metolachlor	4.5	4.0	0.1 a	0.8 a	0.2 ab	0.1
	6.7	6.0	1.3 b	1.4 b	0.1 a	0.1
	9.0	8.0	2.7 c	1.7 b	0.8 b	0.9
	13.5	12.0	3.5 c	2.3 c	0.5 ab	0.5

[z]0 - no effect, 10 = complete kill.

[y]Mean ratings within columns followed by the same letter are not significantly different at the 0.05 level determined by categoric modeling and with the significance level adjusted by Sidaks inequality.

[x]Days after treatment for 'Delaware Valley White'/'Hinocrimson'.

[w]Non-significant at the 5% level.

significant phytotoxicity occurred during 1988 (data not shown). Metolachlor at 6.7 kg/ha (6.0 lb/A) applied on July 17, 1987 caused foliar injury of 15 to 25% for up to 72 days to established azaleas including 'Delaware Valley White', 'Double Pink', 'Hershey Red', 'Hot Shot', 'Karen', 'Lady Robin', 'Rosebud', and 'Tradition' (Table 2). Metolachlor at 6.7 kg/ha (6.0 lb/A) did not damage the azalea variety Pleasant White. No foliar damage occurred on any azalea variety during the 1988 growing season (Eric. I) (Table 2).

Applications of metolachlor at 6.7 kg/ha (6.0 lb/A) on July 17, 1987 to coast leucothoe and PJM rhododendron caused damage of 20 and 10%, respectively at 63 days (Table 2). Compact Japanese andromeda was not injured with this treatment. No damage was observed on these three ericaceous species during the 1988 growing season (Eric. I) (Table 2).

Table 2. Injury to Ericaceous species (spring planted) 72 days after treatment (Sept. 17) as influenced by a single application of metolachlor (Dual 8E) at 6.7 kg/ha (6.0 lb/A) on July 6, 1987[z,y]

Species	Untreated control	72 days
'Delaware Valley White'	0.0[x]	1.5 b
'Double Pink'	0.0	2.0 b
'Hershey Red'	0.0	2.0 b
'Hot Shot'	0.0	2.5 b
'Karen'	0.0	1.5 b
'Lady Robin'	0.0	2.5 b
'Pleasant White'	0.0	0.0 a
'Renee Michelle'	0.0	2.0 b
'Rosebud'	0.0	1.5 b
'Tradition'	0.0	2.0 b
Coast leucothoe	0.0	2.0 b
Compact Japanese andromeda	0.0	0.0 a
'PJM' rhododendron	0.0	1.0 b

[z]0 - no effect, 10 = complete kill.

[y]Mean ratings within columns followed by the same letter are not significantly different at the 0.05 level determined by categoric modeling and with the significance level adjusted by Sidaks inequality.

[x]Non-significant at the 5% level.

Plant size. Established 'Delaware Valley White', 'Hershey Red', and 'Hinocrimson' treated with metolachlor at 2.2, 4.5, or 9 kg/ha (2, 4 or 8 lb/A) were as large as the untreated control plants during the entire study (Azalea I) (data not shown).

Newly planted 'Delaware Valley White' azaleas treated with metolachlor at rates of 4.5 (4.0 lb/A) to 13.5 kg/ha (12.0 lb/A) were smaller than the control plants at the end of 1987 (Azalea II) (Table 3). This trend was the same during 1988 for those plants treated with metolachlor at 9.0 (8.0 lb/A) and/or 13.5 kg/ha (12.0 lb/A) (Azalea II) (Table 3).

No size reduction of 'Hinocrimson' azaleas (Azalea III) occurred during 1987 or 1988 with metolachlor application at 9.0 kg/ha (8.0 lb/A) or less; however, those treated at the 13.5 kg/ha (12.0 lb/A) rate were smaller than the control plants during most of the 2 year study but were of similar size at harvest (Table 3).

Established plants of 'Delaware Valley White' treated in July 1987 with metolachlor at 6.7 kg/ha (6.0 lb/A) were smaller (14%) than the control plants at the end of the 1988 growing season (Eric. I) (data not shown). Coast leucothoe treated with metolachlor at 6.7 kg/ha (6.0 lb/A) were also smaller (15%) than the control plants at harvest (Eric. I) (data not shown). Compact Japanese andromeda and 'PJM' rhododendron treated at this rate were similar to the control plants at harvest (Eric. I) (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 the registration by appropriate state and/or federal authorities.)

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Table 3. Size (H × W cm²) of 'Delaware Valley White' and 'Hinocrimson' azaleas as influenced by a single application of metolachlor (Dual 8E) on May 19 or May 28, 1987, resp.[z]

	Rate		Days after treatment			
			1987		1988	
Treatment	(kg/ha)	(lb/A)	37/35[y]	121/120	366/364	569/507
			'Delaware Valley White'			
UTC	—	—	333 b	875 c	953 c	1799 b
Metolachlor	4.5	4.0	278 ab	707 ab	817 b	1785 b
	6.7	6.0	307 b	730 b	805 b	1728 b
	9.0	8.0	319 b	712 ab	808 b	1757 b
	13.5	12.0	273 a	598 a	620 a	1520 a
			'Hinocrimson'			
UTC	—	—	259 a	621 b	599 b	1438[x]
Metolachlor	4.5	4.0	239 ab	491 ab	541 ab	1454
	6.7	6.0	230 ab	576 ab	573 b	1436
	9.0	8.0	222 ab	494 ab	511 ab	1335
	13.5	12.0	207 b	449 a	436 a	1302

[z]Mean ratings within columns followed by the same letter are not significantly different at the 0.05 level determined by categoric modeling and with the significance level adjusted by Sidaks inequality.

[y]Days after treatment for 'Delaware Valley White'/'Hinocrimson'.

[x]Non-significant at the 5% level.

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