mental Herbicide 2, a granular herbicide which contains Goal, at the same application rate. With sprayed applications of Goal, residual control of common groundsel lasted approximately 1 month at 0.6 kg/ha (0.5 lb/A), 2 to 3 months at 1.1 kg/ha (1.0 lb/A), 3 to 4 months at 2.2 kg/ha (2.0 lb/A) and 4 months at 4.5 kg/ha (4.0 lb/A).

(*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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Effects of Preemergence Herbicides on Hosta and Daylily[1]

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Abstract

Thirteen preemergence herbicides were evaluated for phytotoxicity to container grown hosta (*Hosta spp.* Tratt. 'Hyacinthina') and daylily (*Hemerocallis spp.* L. 'Sammy Russell'). Severe injury (28 to 55%) was observed from Ronstar (oxadiazon) and Goal (oxyfluorfen) for both species. The other herbicides did not cause visual injury. Three herbicides, Surflan (oryzalin), Endurance (prodiamine) and Pennant (metolachlor), were selected to investigate plant tolerance in field plantings at 1.1, 2.2, and 4.5 kg/ha (1, 2, and 4 lb/A). None of these herbicides caused visual injury or reduced shoot or root weight for 60 or 90 days after treatment. Daylily flower number was not affected by any of the herbicide treatments.

Index words: phytotoxicity, herbicides, weed control

Herbicides used in this study: Cinch (cinmethyalin) *exo*-1-methyl-4-(1-methylethyl)-2-[(2-methylphenyl)methoxy-7-oxabicyclo[2.2.1]heptane; Devrinol (napropamide) 2-(-naphthoxy)-N,N-diethylpropionamide; Endurance (prodiamine) 2,4-dinitro-N^3,N^3-dipropyl-6-(trifluoromethyl)-1,3, benzenediamine; Eptam (EPTC) S-ethyl dipropylthiocarbamate; Goal (oxyfluorfen) 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene; Pennant (metolachlor) 2-chloro-*N*-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methyethyl)acetamide; Premier (flumetralin) 2-chloro-N-[2,6-dinitro-4-(trifluoro-methyl) phenyl-n-ethyl-6-fluoro-benzene-methanamine; Prowl (pendimethalin) *N*-(1-ethypropyl)-3,4-dimethyl-2,6-dinitrobenzene-amine; Ronstar (oxadiazon) 3-[2,4-dichloro-5-(1-methylethoxy)phenyl-5-(1,1-dimethylethyl)-1,3,4-oxadiazole; Surflan (oryzalin) 4-(dipropylamino)-3,5-dinitrobenzenesulfonamide; Treflan (trifluralin) 2,3-dinitro-N-N-dipropyl-4-(trifluoromethyl)benzeneamine; XL (oryzalin + benefin) *N*-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl)benenamine

Introduction

Weed control in herbaceous perennial landscape plantings is limited because of the lack of labeled herbicides. Effective preemergence herbicides are available to control a broad spectrum of weeds in woody plantings, however most of these are not labeled for herbaceous perennials. Bing (1) reported considerable variation in the response of perennials to preemergence herbicides. Goal (oxyfluorfen) injured field grown hosta and daylilies and neither species recovered. Surflan (oryzalin) caused early injury to both species, but they recovered. Currently, the only herbicides labeled for use in daylily are Ornamental Weeder (chloramben), Eptam (EPTC), and Fusilade (fluazifop-P). Devrinol (napropamide) and Fusilade (fluazifop-P) are labeled for use in hosta.

Several other herbicides have labels for use in landscape plants, and if these labels could be expanded it would greatly assist weed management efforts for herbaceous perennials. Surflan (oryzalin) controlled Pennsylvania bittercress (*Cardamine pensylvanica* Muhl. ex. Willd.), large crabgrass (*Digitaria sanquinalis* (L.) Scop.), yellow woodsorrel (*Oxalis stricta* L.), common purslane (*Portulaca oleracea* L.),

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Materials and Methods

For the preliminary experiment, dormant, bare root daylily (*Hemerocallis spp.* Tratt 'Sammy Russell') and *Hosta spp.* L. 'Hyacinthina' were planted on March 25, 1987 in 2.56 l (1#) containers in a Norfolk sandy loam (fine loamy, siliceous, thermic, Typic Paleudults) soil with a pH of 6.1. Daylilies were grown in full sun and hosta was placed under 55% shade. After plant emergence, two uniform plants which had 2–3 shoots and were 7–10 cm (3–4 in) tall were treated. On April 20, 1987, granular herbicides were applied by hand with a shaker, and liquid herbicides were applied with CO_2 backpack sprayer delivering 187 liter/ha (20 gpa). Herbicides, rates and formulations are listed in Table 1. Visual evaluations were made in order to assess phytotoxicity before establishing other field studies.

For the field studies, bare root daylily and hosta were planted on May 7, 1988, in weed free, tilled (15 cm—6 in deep) soil. Hosta was planted in 1 m (3.3 ft) rows with 1 m (3.3 ft) between plants in an amended Cecil series soil (clayey, kaolinitic, thermic Typic Hapludults) and covered with 55% shade fabric. Soil test results showed medium to high levels of P, K, Mg, and Ca with pH of 5.9. Two weeks after planting each plant was fertilized with 3 g of KNO_3 and then 5 g of 16N-1.7P-6.6K (16-4-8), 10 days later. Daylilies were planted in 1.5 m (5 ft) rows with 1 m (3.3 ft) between plants in a Congaree silt loam (Typic Udifluvents) in full sun. Soil test results indicated medium to high levels of P, K, Mg, and Ca with pH of 6.2. Fertilization was the same as for hosta. Both species were watered as needed with drip irrigation. Three herbicides were selected based on the lack of injury in the preliminary study, the weeds controlled reported in the literature and the herbicide labels. Surflan (oryzalin), Endurance (prodiamine), and Pennant (metolachlor) were applied May 21, 1987 at 1.1, 2.2, and 4.5 kg/ha (1, 2, and 4 lbs ai/A) with a CO_2 pressurized backpack sprayer delivering 187 liter/ha (20 gpa). Treatments were arranged in randomized complete block design with plot size of 1 m^2 (3.3 ft^2) and 6 single plant replications. Visual injury ratings and plant height were measured biweekly for 3 months for daylilies and 2 months for hosta with only 1 evaluation reported because no differences were observed. Shoot and root dry weights were taken at 2 and 3 months after treatment for hosta and daylily, respectively. Number of shoots were also counted at 2 weeks for hosta and flower number was recorded at 3 months for daylily.

Results and Discussion

Both hosta and daylily were injured by Ronstar (oxadiazon) and Goal (oxyfluorfen) at both rates in the preliminary study (Table 1). Visual injury appeared as necrotic leaves and stunted growth. This is important because these herbicides were widely used in nursery weed control programs, thus may be considered acceptable for landscape weed control. Goal (oxyfluorfen) is the principle component of Ornamental Herbicide-2 and Rout. The other herbicides studied did not cause any observable injury to either hosta or daylily.

In the field study, daylily was also not injured by the selected herbicides even at the highest rate (Table 2). Plant quality as determined by height, flower number, shoot and root dry weight was not reduced regardless of herbicide or rate.

Hosta was not affected by the herbicides at any rate in the field study (Table 3). Shoot number, height, and shoot and root dry weights were similar to the untreated control plants at two months after herbicide application.

Table 1. Phytotoxicity of preemergence herbicides on containerized hosta and daylily in a Dothan sandy loam soil.

Herbicide	Formulation	Rate kg/ha	Rate (lb/A)	% Injury[z] hosta	% Injury[z] daylily
Treflan (trifluralin)	5G	1.1	1	0	0
Treflan	5G	2.2	2	0	0
Surflan (oryzalin)	4AS	1.1	1	0	0
Surflan	4AS	2.2	2	0	0
Prowl (pendimethalin)	2.4G	1.1	1	0	0
Prowl	2.4G	2.2	2	0	0
XL (oryzalin + benefin)	2G	1.1	1	0	0
XL	2G	2.2	2	0	10
Endurance (prodiamine)	65DF	1.1	1	0	0
Endurance	65DF	2.2	2	0	0
Premier (flumetralin)	1.2EC	1.1	1	0	0
Premier	1.2EC	2.2	2	0	0
Cinch (cinmethyalin)	0.5G	1.1	1	0	0
Cinch	0.5G	2.2	2	0	0
Ronstar (oxadiazon)	2G	1.1	1	45	28
Ronstar	2G	2.2	2	53	30
Eptam (EPTC)	10G	2.8	2.5	0	0
Eptam	10G	5.6	5	0	5
Pennant (metolachlor)	5G	1.1	1	0	0
Pennant	5G	2.2	2	0	0
Devrinol (napropamide)	5G	1.1	1	0	0
Devrinol	5G	2.2	2	0	0
Goal (oxyfluorfen)	2G	1.1	1	48	28
Goal	2G	2.2	2	55	43
Control	–	–	–	0	0
LSD (0.05)				29	12

[z]Visual injury was rated on a scale of 0 = no injury and 100 = complete plant death.

Table 2. Effect of preemergence herbicides on daylily growth.

Herbicides/Rates	Injury 30 DAT[z] (%)	Plant Ht. 38 DAT (cm)	Flower No. 90 DAT	Shoot Wt. 90 DAT (g)	Root wt. 90 DAT (g)
Herbicides					
Surflan (oryzalin)	8	24.3	18.1	27.7	54.2
Endurance (prodiamine)	6	25.2	16.7	27.8	44.1
Pennant (metolachlor)	12	23.1	18.2	24.7	48.9
Rates kg/ha (lb/A)					
1.1 (1)	8	24.9	19.1	28.1	46.4
2.2 (2)	11	23.7	16.8	23.7	39.8
4.4 (4)	8	24.1	17.1	28.4	48.8
	ns[y]	ns	ns	ns	ns
Control	3	26.3	21.2	35.5	48.8

[z]DAT = days after treatment.

[y]Not significant according to ANOVA with factorial analysis.

Table 3. Effect of preemergence herbicides on hosta growth.

Herbicides/Rates	Shoot No. 16 DAT[z]	Injury 30 DAT (%)	Plant Ht. 35 DAT (cm)	Shoot Wt. 60 DAT (g)	Root Wt. 60 DAT (g)
Herbicides					
Surflan (oryzalin)	3.5	18	9.8	6.4	12.4
Endurance (prodiamine)	2.8	6	10.8	6.7	13.6
Pennant (metolachlor)	3.3	11	9.9	6.4	12.1
Rates kg/ha (lb/A)					
1.1 (1)	3.4	9	10.5	6.8	15.4
2.2 (2)	3.2	11	10.1	5.7	10.7
4.4 (4)	3.0	15	9.9	7.0	11.9
	ns[y]	ns	ns	ns	ns
Control	3.2	5	11.2	7.5	18.8

[z]DAT = days after treatment

[y]Not significant according to ANOVA with factorial analysis.

Bing (1) reported permanent injury to field grown hosta and daylily with Goal (oxyfluorfen) but only temporary stunting from Surflan (oryzalin). Our data indicates similar results with Goal (oxyfluorfen), but no significant injury was detected with Surflan (oryzalin). This could be due to the soil type differences between the studies or plant stage of development. Ronstar (oxadiazon) has injured other perennials including *Rudbeckia*, *Bellis*, and *Achillea*, therefore, injury observed in this study is not surprising (1). Although it is possible that other cultivars, other growth stages or in other soils, hosta and daylily may be more susceptable than in this study. Our data indicate that Surflan (oryzalin), Endurance (prodiamine) and Pennant (metolachlor) could be used safely on hosta and daylily landscape plants at the rates tested.

Significance to the Nursery Industry

Weed control in herbaceous perennials is a major problem. Thirteen preemergence herbicides were evaluated for injury to hosta and daylily. Ronstar (oxadiazon) and Goal (oxyfluorfen) caused severe injury to both species. Surflan (oryzalin), Endurance (prodiamine), and Pennant (metolachlor) did not injure hosta or daylily in field studies and these herbicides should improve weed control when they are labeled.

(*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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