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Control of Florida Betony (*Stachys floridana* Shuttlew.) Emerging From Tubers[1]

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Abstract

Derby (metolachlor + simazine), Pennant (metolachlor), and Princep (simazine) were tested at two sites to determine if they would provide control of Florida betony (*Stachys floridana* Shuttlew.) similar to Barricade (prodiamine). These herbicides were applied twice to containerized Florida betony grown from tubers—a preemergent application in September, 1992 and a postemergent application in November, 1992. Only Barricade (prodiamine) provided 14 weeks of good to excellent control at both sites. Pennant (metolachlor) at 5.4 kg ai/ha (4.8 lb ai/A) provided control equivalent to Barricade (prodiamine) 6 weeks after the initial application at one site and poorer but acceptable control at the other site. Derby (metolachlor + simazine) and Pennant (metolachlor) tended to reduce number of shoots and/or percent coverage compared to an untreated control but generally provided poor control. Princep (simazine) was ineffective.

Index words: landscape, weed control, herbicide.

Herbicides used in this study: Barricade 65WG (prodiamine), (N^3, N^3-Di-n-propyl-2,4-dinitro-6-(trifluoromethyl)-m-phenylenediamine); Pennant 5G (metolachlor), (2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide); Princep Caliber 90WDG (simazine), (6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine); Derby 5G (metolachlor + simazine).

Significance to the Nursery Industry

In a study replicated at two sites, two applications of Derby (metolachlor + simazine), Pennant (metolachlor), or Princep (simazine) could not provide the 14 weeks of good to excellent control (6 to 15% coverage) that resulted from two applications of Barricade (prodiamine) at 4.5 kg ai/ha (4 lb ai/A) in September and November of the same year. Although Derby (metolachlor + simazine) at 6.7 kg ai/ha (6.0 lb ai/A) and Pennant (metolachlor) at 5.4 kg ai/ha (4.8 lb ai/A) had some activity against Florida betony for 6 weeks after the initial application (WAI) (19 to 48% coverage, and 14 to 27% coverage, respectively), control was poor (> 80% coverage) at 14 WAI. Princep (simazine) had little to no activity against Florida betony. Currently, Barricade (prodiamine) can only be applied to landscape plants at the rate of 0.84 kg ai/ha (0.75 lb ai/A). Further research on the usefulness of dinitroaniline herbicides such as Barricade (prodiamine) for control of Florida betony is warranted.

Introduction

Florida betony (*Stachys floridana* Shuttlew.) is a major perennial weed problem in landscape beds and turfgrass in the southeast (2). It can grow in full sun to partial shade and tolerates a variety of soil conditions. Primarily a cool season weed, Florida betony reproduces by seeds, underground rhizomes, and tubers. The invasive characteristic of the rhizomes and tubers and the wide range of tolerated habitats make this a weed which can rapidly infest landscape beds.

Handweeding and the use of organic mulches and landscape fabrics can help suppress the proliferation of Florida betony (2). However, Florida betony can quickly reinfest landscape beds by spreading from adjacent infested turf or by pieces of rhizomes and tubers left in the soil after handweeding.

Chemical methods of preventing Florida betony growth or eliminating an existing population are limited. Fumigants can be used as a preplant method to eliminate Florida betony but will not prevent an infestation originating in the turf. To eliminate an existing population, directed applications of Roundup (glyphosate) can be applied at the time of flowering (2). There are no preemergent herbicides currently registered for control of Florida betony in landscape beds but there are two dinitroaniline herbicides that have shown promise. Barricade (prodiamine) at 2.2 and 4.5 kg ai/ha (2 and 4 lb ai/A) provides effective preemergence (seeds) and postemergence control of Florida betony in leatherleaf fern crops (4). However, Barricade (prodiamine) can only be applied to landscape plants at a rate of 0.84 kg ai/ha (0.75 lb ai/A). Taylor and Wilcox (5) reported that another dinitroaniline herbicide, Premier (fluometralin), also provided postemergence control of Florida betony in leatherleaf fern. Postemergence activity of Premier (fluometralin) on Florida betony growing under landscape conditions has also been noted by the authors and will be the subject of a future report. Atrazine, a triazine herbicide marketed under many names, is labelled for control of Florida betony in turf but is not safe for use in landscape beds. Princep (simazine), also a triazine herbicide, may have activity against Florida betony. Simazine is labelled for use in landscape beds under the trade name Derby (metolachlor + simazine), a granular herbicide that also contains metolachlor, the active ingredient in Pennant.

The objective of this study was to determine if repeat applications of Pennant (metolachlor), Princep (simazine), or Derby (metolachlor + simazine) would provide good to excellent Florida betony control.

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Materials and Methods

This experiment was conducted at the North Florida Research and Education Center, Monticello, and Florida A&M University, Tallahassee.

Tubers of Florida betony were harvested from mature plants growing under 30% shade in early September 1992. Healthy tubers were stored in a plastic bag at room temperature until transplanted.

On September 26, 1992, three tubers were planted in 2.5 liter (2.6 qt) containers about 2.5 cm (1 in) deep in a medium composed of pine bark:Canadian sphagnum peat:sand (3:1:1 by vol). One cubic meter (1.3 yd^3) of medium was amended with 6.1 kg (13.5 lb) dolomite, 3.1 kg (6.8 lb) triple superphosphate, 0.9 kg (2.1 lb) Micromax (12S-0.1B-0.5Cu-12Fe-2.5Mn-0.05Mo-12Zn), and 6.1 kg (13.5 lb) Osmocote 18N-2.6P-1.0K (18-6-12). A top dressing of 7 g (2.5 oz) Osmocote 18N-2.6P-1.0K (18-6-12) was applied to each pot after the tubers were planted. A representative subsample of 20 tubers had a mean (± SE) of 12.2 ± 0.4 nodes, fresh weight of 5.4 ± 0.2 g, and dry weight of 0.80 ± 0.04 g. On September 28 and November 25, 1992, the herbicide treatments were applied (see Table 1). The treatments were designed so that equivalent amounts of simazine (Princep) and metolachlor (Pennant) were applied in relation to the Derby (metolachlor + simazine) rates. Untreated pots and Barricade (prodiamine) were included as controls. The sprayable herbicides were applied preemergence (September 28) and postemergence (November 25) over-the-top (OT) using a compressed-air backpack sprayer calibrated to deliver 374 liters/ha (40 gpa) through a single 8002E Teejet flat fan nozzle (Spraying Systems Co., Wheaton, IL) at 35 psi (at nozzle). Granular herbicides were applied by hand OT pre- and postemergence to each container. Immediately after her-

Table 1. Herbicidal control of *Stachys floridana* Shuttlew. at two locations.

		Weeks after initial application[z,y]							
	Rate	6			14				
								Total shoot wt (g)	
Herbicide	kg ai /ha	Injury rating[x]	No. of shoots[w]	Percent coverage[v]	Injury rating	No. of shoots	Percent coverage	Fresh	Dry
		Monticello							
Untreated	—	0	13.8	99	0	99.1	100	215.2	25.3
Barricade WG	4.5	79.3	2.5	5	79.3	3.2	15	7.6	1.1
Princep WDG	0.4	2.7	12.4	96	0.7	91.2	100	202.4	24.6
Princep WDG	0.9	4.7	11.2	95	0	93.0	100	207.3	20.9
Princep WDG	1.3	2.7	12.5	96	1.3	95.2	100	226.6	22.0
Derby G	2.2	15.3	7.8	81	2.0	63.4	100	163.4	20.0
Derby G	4.5	39.3	5.1	46	13.3	46.6	100	123.4	13.1
Derby G	6.7	35.3	3.9	48	10.7	24.4	98	107.9	13.0
Pennant G	1.8	19.3	7.6	62	5.3	64.2	100	148.5	17.9
Pennant G	3.6	22.7	5.5	64	5.3	40.5	100	140.8	16.1
Pennant G	5.4	53.3	4.0	27	20.0	17.4	96	92.3	10.5
Dunnett's MSD	(0.05)[z]	20.3	4.1	18	10.0	16.1	9	44.4	5.4
		Tallahassee							
Untreated	—	0	12.7	98	0	89.7	100	242.1	24.5
Barricade WG	4.5	90.7	0.7	1	90.0	1.6	6	2.4	0.3
Princep WDG	0.4	5.3	9.2	90	0	78.3	100	183.1	18.6
Princep WDG	0.9	10.0	9.0	87	1.3	79.1	100	163.4	14.8
Princep WDG	1.3	7.3	10.2	92	0	88.5	100	208.9	16.4
Derby G	2.2	15.3	7.8	66	1.3	64.1	100	177.3	16.6
Derby G	4.5	49.3	4.6	25	23.3	40.5	84	104.1	9.3
Derby G	6.7	53.3	4.3	19	18.7	38.5	94	110.5	10.6
Pennant G	1.8	20.0	7.2	64	4.0	70.6	100	160.3	15.9
Pennant G	3.6	33.3	5.7	39	12.7	43.1	100	134.0	13.8
Pennant G	5.4	56.0	3.2	14	30.7	36.7	80	81.8	8.0
Dunnett's MSD	(0.05)[z]	25.1	2.7	16	21.3	24.0	23	49.3	5.5
Significance[u]									
TRT		***	***	***	***	***	***	***	***
SITE		*	*	**	*	NS	NS	NS	*
TRT × SITE		NS	NS	NS	NS	NS	NS	NS	NS

[z]Herbicides were applied on September 28 and November 25, 1992. Three tubers were planted 2.5 cm deep in a containerized medium 2 days before herbicide application.

[y]Treatment means compared to Barricade WG by a Dunnett's test, $\alpha = 0.05$; minimum significant difference is listed.

[x]Injury rated on a scale of 0 to 100, with 0 = no injury and 100 = plant death.

[w]Statistical analysis performed after square root transformation; retransformed results are presented.

[v]Statistical analysis performed after arc sine square root transformation; retransformed results are presented.

[u]NS,*,**,*** Nonsignificant, or significant at P = 0.05, 0.01, or 0.001, respectively.

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bicide application, containers were overhead irrigated with 1.2 cm (0.5 in) water. Herbicide efficacy was evaluated 6 and 14 weeks after the initial application (WAI). At 6 and 14 WAI, number of shoots, percent coverage of the medium, and foliar injury were determined. Injury was rated on a scale of 0 to 100, with 0 = no injury and 100 = plant death. Shoot fresh and dry weight were determined at 14 WAI. Control was termed excellent if coverage was ≤ 10%, good if coverage was ≤ 20% but > 10%, and fair if coverage was ≤ 30% but > 20%; coverage > 30% was considered poor.

The experiment was set up as split plot design, with site as the main plot and herbicide as the subplot. There were five replications per treatment and three pots per replication. Data were analyzed by General Linear Model (GLM) procedures (3). Percentage data and count data were transformed (arcsin square root and square root, respectively) before analysis; retransformed means are presented. A Dunnett's test ($\alpha = 0.05$) was used to compare treatment efficacy to Barricade (prodiamine) and the untreated control; minimum signficant differences were the same for both sets of comparisons.

Containers in Monticello were overhead irrigated daily with 0.25 cm (0.1 in) water while those in Tallahassee were overhead irrigated every other day with 1.2 cm (0.5 in) water. Total rainfall in Monticello and Tallahassee for the experimental period was 29.9 cm (11.8 in) at both sites. Therefore, the total water received at Monticello and Tallahasssee was 55.9 cm (22 in) and 98.3 cm (38.7 in), respectively. The mean minimum/maximum temperatures in Monticello and Tallahassee were 9.7C/21.6C (49.5F/70.9F) and 13.7C/23.9C (56.7F/75.1F), respectively. Containers at both sites were in full sun.

Results and Discussion

Herbicide and site influenced Florida betony control, with site primarily being a significant factor only at 6 WAI (Table 1). There was no interaction between herbicide and site. Despite significant site effects and large differences in irrigation, the trends were similar at both sites at 6 and 14 WAI. Two applications of Barricade (prodiamine) provided 14 weeks of good to excellent control (6 to 15 % coverage). None of the other herbicides were as effective as Barricade (prodiamine) at 14 WAI. At 6 WAI, the highest rates of Pennant (metolachlor) and Derby (metolachlor + simazine) gave good control of Florida betony (14 and 19% coverage, respectively) at Tallahassee; however, these rates of Pennant (metolachlor) and Derby (metolachlor + simazine) provided only fair to poor control (27 and 48% coverage, respectively at Monticello). The activity of Derby (metolachlor + simazine) was probably due to the metolachlor contained in this preformulated mixture of simazine and metolachlor, since Princep (simazine) provided virtually no control of Florida betony (Table 1).

Although none of the herbicides were as effective as Barricade (prodiamine) for Florida betony control, all herbicides caused some degree of foliar damage (Table 1). The few shoots that did emerge in the Barricade treatment were severely stunted with small, slightly distorted leaves that had a reddish overtone. Injury caused by the other herbicides was generally rate dependent, although this was not necessarily obvious from the data. Princep (simazine) caused foliar chlorosis and marginal necrosis as well as a slight reduction in plant size. Pennant (metolachlor) reduced plant size up to ~50% and caused marginal necrosis. As expected, Derby (metolachlor + simazine) caused damage that was characteristic of Princep (simazine) and Pennant (metolachlor).

In conclusion, two applications of Pennant (metolachlor), Princep (simazine), or Derby (metolachlor + simazine) could not provide 14 weeks of acceptable Florida betony control in a soilless containerized medium. However, the efficacy of these herbicides might be greater in the mineral soils found in landscapes than in a high organic matter content medium used in this experiment. Blumhorst et al. (1) showed a direct relationship between the herbicidal activities of atrazine, metolachlor, and pendimethalin (a dinitroaniline herbicide) and organic matter content. They predicted that as soil organic matter content increased, higher rates of these herbicides were required for equivalent weed control. Further research on the usefulness of dinitroaniline herbicides such as Barricade (prodiamine) for control of Florida betony is also warranted.

(*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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