Sethoxydim (Poast) and Oxyfluorfen (Goal) Efficacy and Tolerance by Landscape Plants[1]

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Abstract

Granular Goal (oxyfluorfen) [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(tri-fluoromethyl)benzene] at 4.5 kg/ha (4.0 lb/A) was applied to 8 species of woody landscape plants alone or with a following postemergence application of Poast (sethoxydim) [2-(1-(ethoxyimino)butyl)-5-(2-(ethylthio)propyl)-3-hydroxy-2-cyclohexen-1-one] at 0.6 or 1.1 kg/ha (0.5 or 1.0 lb/A). Sethoxydim was applied with and without crop oil (1%, v/v). These treatments were made one time in 1981 and 1982. Applications of Poast (sethoxydim) at 0.6 kg/ka (0.5 lb/A) with or without crop oil controlled barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], giant foxtail (*Setaria faberi* Herrm.), and large crabgrass [*Digitaria sanguinalis* (L.) Scop.]. Goal (oxyfluorfen) alone at 4.5 kg/ha (4.0 lb/A) reduced the rate of estasblishment of the perennial broadleaf weeds Canada thistle [*Cirsium arvense* (L.) Cyrillo] and white heath aster (*Aster pilosus* Willd.). Up to 86% reduction in total weed cover was obtained when Goal (oxyfluorfen) application was followed by Poast (sethoxydim). Crop quality was not affected by any herbicide treatments.

Index words: Postemergence herbicide, granular herbicide, grass control

Introduction

Nursery and landscape plant species are grown for aesthetic and utilitarian purposes. Optimum growth and appearance requires adequate weed control. Presently used methods of weed control are time-consuming, expensive, and often cause damage to ground cover and other landscape plantings.

Goal has been investigated for weed control in woody ornamentals. Ahrens and Cubanski (1) reported control of broadleaf weeds in conifer seedbeds with 0.5 kg/ha (0.44 lb/A) Goal. Frank, et al. (7) reported significantly larger azalea (*Rhododendron* sp.) plants in plots treated with 2.2 and 4.5 kg/ha (2.0 and 4.0 lb/A) Goal than those in control plots. Creager (6) reported that 4 months of weed control were obtained with Goal at 4.5 and 9.0 kg/ha (4.0 and 8.0 lb/A) in 4 species of container-grown woody landscape plants with little or no injury. Goal inadequately controlled grass weeds (5). Poast is a recently developed herbicide for postemergence grass control. Chow (3) reported excellent postemergence control of wild oat (*Avena fatua* L.) in flax (*Linum usitatissimum* L.) with Poast at 0.3 kg/ha (0.26 lb/A). Quackgrass [*Agropyron repens* (L.) Beauv.] growth was reduced with 0.6 kg/ha (0.5 lb/A) Poast (10). Grass weeds were controlled by Poast in container-grown nursery plants with little to no plant injury (2). Selected weed and turf grasses have been controlled by Poast applications of 1.1 kg/ha (1.0 lb/A) (4), whereas 8 nursery and landscape species tolerated postemergence applications up to 4.4 kg/ha (4.0 lb/A) (4).

Field studies were established in 1981 at Frederick and Beltsville, MD, to evaluate the herbicidal efficacy of Goal, alone or followed by Poast with and without crop oil, and the tolerance of 8 selected nursery and landscape species to these treatments.

Materials and Methods

This field research was conducted at Frederick and Beltsville, Maryland in 1981 and 1982. The soils were classified as Duffield silt loam (Ultic Hapludalf) at Frederick, and Keyport silt loam (Aquic Hapludult) at Beltsville. Experimental fields at both locations were clean cultivated prior to transplanting 1 to 3-yr-old nursery stock in May and June of 1981. Two plants each of the following six species were planted on 1.2 m (3 ft) centers in each plot: Andorra juniper (*Juniperus horizontalis* 'Plumosa' Rehd.), low-fast cotoneaster (*Cotoneaster dammerii* Schneid.), Hicks yew (*Taxus media* 'Hicksii' Rehd.), hinocrimson azalea (*Rhododendron x Hinocrimson*), crownvetch (*Coronilla varia* L.), and periwinkle (*Vinca minor* L.). In addition, four plants each of Japanese spurge (*Pachysandra terminalis* Sieb. and Zucc.) and English ivy (*Hedera helix* L.) were planted in pairs in each plot on 1.2 m (3 ft) centers. The experimental design was a randomized complete block with three replications at both locations. Plots were 3x11 m (10x36 ft). Pre-plant fertilization was adequate for good plant growth and irrigation was provided as needed. Weeds were hand-pulled as needed around each test plant for approximately 0.25 m (0.8 ft) to enhance plant survival.

Herbicide treatments were as follows: Goal 2% granular was applied with a hand held spinner spreader at 4.5 kg/ha (4.0 lb/A) alone or with a following treatment of Poast at 0.6 or 1.1 kg/ha (0.5 or 1.0 lb/A) alone or in combination with crop oil concentrate at 1% (v/v). Poast was also applied at both rates without a preceding Goal application. Goal was broadcast 12 days after transplanting (DAT), June 8, 1981, and 28 DAT, July 10, 1981 at Frederick and Beltsville, respectively. Plots

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were weed free at Frederick, but those at Beltsville contained common purslane [*Portulaca oleracea* (L.)] when Goal was applied. Poast was applied with a bicycle mounted boom sprayer in 374 L/ha (40 g/A) using flatfan nozzles. Application dates were June 16, 1981 and July 16, 1981 at Frederick and Beltsville, respectively. The soil surface was moist at Frederick when Goal was applied and 0.25 cm (0.1 in) of rainfall occurred the following day. Rain (1.90 cm (0.75 in)] occurred 11 days after Goal was applied to a dry soil surface at the Beltsville site. In 1982, the soil surfaces at both locations were dry when Goal was applied to weed-free plots on May 19. Within 24 hours after Goal applications, 1.27 cm and 0.13 cm (0.5 and0.05 in) of rainfall occurred at Beltsville and Frederick, respectively. Poast was applied as in 1981, on June 16 and June 30, 1982, at Frederick and Beltsville, respectively. In both years and locations, Poast was applied when wind velocity was less than 2.6 km/hr (1.6 mph) on dew-moist leaf surfaces. Grasses were 10 to 20 cm (4 to 8 in) tall at Frederick in 1981 and 1982 and Beltsville in 1982 when Poast was applied. In 1981, weedy grasses were 25 to 45 cm (10 to 18 in) tall at Beltsville when Poast was applied.

Percent weed cover was estimated several times during each growing season. Thirteen broadleaf weeds, 5 grasses, and yellow nutsedge were recognized as the major weed species at one or more locations (Table 1), and their percentage of total weed cover was estimated throughout each growing season. Test plants were rated on a scale of 0 to 10, with 10 being plant death. Values greater than three reflected nonmarketable plants. Plant height and width measurements were used to document plant growth.

Percent weed control was obtained by comparing weed cover in treatment plots with weed cover in untreated control plots.

Results and Discussion

Percent weed cover. Seasonal increases in weed cover occurred at both sites. However, the nature of the biomass was a function of the treatment. The presence of common purslane prior to Goal treatments in plots at Beltsville in 1981 confounded the interpretation of broadleaf weed control data for that site. All treatments of Goal followed by Poast resulted in end of season mean weed cover of 2% due to annual grasses at both locations and 33% due to broadleafs at Frederick. Weed cover was less in plots treated with Goal followed by Poast than in plots treated with either herbicide alone (Table 2). Untreated control and Goal only plots were rapidly dominated by annual grasses. Plots that did not receive Goal, but were treated with Poast, were dominated by annual and perennial broadleafed species. Control of annual broadleafs and grasses such as common lambsquarters, redroot pigweed, and giant foxtail by Goal followed by Poast permitted the gradual establishment of perennial broadleafs. In 1981 and 1982 at Frederick, perennial broadleafs such as Canada thistle and white heath aster were the dominant flora (mean ground cover, 19%) in plots where annual species competition had been reduced by Poast and Goal treatments. On similarly treated plots at Beltsville, perennial broadleafs were only 5% of the ground cover in 1982; however, by the spring of 1983, perennial broadleaf species had increased their contribution by at least one third to the weed flora at Beltsville.

Weed species controlled. One application of Poast (Table 2) provided up to 100% control of grasses for the entire growing season in 1981 and 1982. Lesser control was related to grass seed germination after herbicide application. The addition of crop oil or increase in application rate from 0.6 to 1.1 kg/ha (0.5 to 1.0 lb/A) of Poast did not improve grass control. Kuhns et al. (9) reported that crop oil, when used with 0.6 kg/ha (0.5 lb/A) of Poast, did not enhance grass control. Hartzler and Foy (8) reported no increases in activity on large crabgrass (*Digitaria sanguinalis* (L.) Scop.) when an adjuvant was added to 0.3 or 0.6 kg/ha (0.26 or 0.50 lb/A) of Poast, although significant increases in activity were observed when adjuvants were applied with lower rates of Poast.

Large crabgrass, giant foxtail, barnyardgrass, and fall panicum were not satisfactorily controlled by applications of Goal without Poast. Annual broadleaf weeds were generally well controlled (up to 100%) at Frederick by preemergence applications of Goal plus perennial broadleaf competition. Although some perennial broadleaf weed control was noted, Canada thistle and white heath aster gradually became established as dominant weeds.

Table 1. Major weed species in experimental plots at Beltsville and Frederick, 1981 and 1982.[z]

Dicots	Monocots
Broadleaf dock (F) *Rumex obtusifolius* L.	Barnyardgrass (B) *Echinochloa crus-galli* (L.) Beauv.
Canada thistle (F) *Cirsium arvense* (L.) Scop.	Fall panicum (B,F) *Panicum dichotomiflorum* Michx.
Common lambsquarters (B,F) *Chenopodium album* L.	Giant foxtail (B,F) *Setaria faberi* Herrm.
Common purslane (B,F) *Portulaca oleracea* L.	Large Crabgrass (B,F) *Digitaria sanguinalis* (L.) Scop.
Common ragweed (F) *Ambrosia artemisiifolia* L.	Stinkgrass (B) *Eragrostis cilianensis* (All.) Lutati
Curly dock (F) *Rumex crispus* L.	Yellow nutsedge (B,F) *Cyperus esculentus* L.
Horseweed (F) *Conyza canadensis* (L.) Cronq.	
Mustard (B,F) *Barbarea vulgaris* R. Br.	
Redroot pigweed (B,F) *Amaranthus retroflexus* L.	
Rough fleabane (B,F) *Erigeron strigosus* Muhl.	
Smallflower galinsoga (B) *Galinsoga parviflora* Cav.	
Velvetleaf (B,F) *Abutilon theophrasti* Medic.	
White heath aster (B,F) *Aster pilosus* Willd.	

[z](B) Beltsville; (F) Frederick

Table 2. Mean weed cover and percent control of grass and broadleaf weeds.[z]

Treatment[x]	Rate		Beltsville[y]						Frederick[y]					
			1981			1982			1981			1982		
	kg/ha	(lb/A)	WC[w]	AG[v]	BL[v]	WC	AG	BL	WC	AG	BL	WC	AG	BL
			%											
Poast	0.6	(0.5)	100ns	100a	8b	75ab	77ab	6c	67ab	99a	0c	56a-e	97a	0c
	1.1	(1.0)	98	100a	0b	68ab	63b	30abc	19a	100a	0c	68abc	90a	0c
Poast plus crop oil	0.6	(0.5)	98	100a	0b	73ab	78ab	5c	84ab	98a	0c	74ab	100a	0c
	1.1	(1.0)	93	100a	2b	73ab	91ab	0c	97a	100a	0c	80a	100a	0c
Goal	4.5	(4.0)	100	0d	73a	100a	0c	81a	97a	1c	100a	64a-d	54b	19bc
Goal followed by Poast	4.5 0.6	(4.0) (0.5)	98	88b	8b	23c	98a	66ab	49bcd	98a	47b	36def	91a	55ab
	4.5 1.1	(4.0) (1.0)	95	97a	2b	32bc	98a	48ab	16d	99a	81ab	16f	100a	77a
Goal followed by Poast plus crop oil	4.5 0.6	(4.0) (0.5)	98	100a	2b	40bc	99a	45abc	38cd	97a	63ab	32ef	99a	54ab
	4.5 1.1	(4.0) (1.0)	98	97a	0b	50bc	100a	29bc	16d	100a	82ab	14f	100a	80a
Goal followed by crop oil	4.5	(4.0)	100	9c	58a	100a	0c	64ab	70abc	29b	87a	31ef	82ab	32bc

[z]Values followed by same letter within columns are not significantly different at 5% level using Duncan's New Multiple Range Test. Percent control based on comparison with untreated check.
[y]Beltsville values based on data obtained Sept. 14, 1981, and Oct. 15, 1982; Frederick values based on data obtained Oct. 8, 1981, and Sept. 15, 1982.
[x]Crop oil supplied by BASF Wyandotte Corporation with sethoxydim; 85% paraffin base petroleum oil and 15% surfactant blend; crop oil concentrate at 1% v/v in sethoxydim treatments.
[w]WC = % weed cover.
[v]AG = % control annual grasses; BL = % control all broadleafed weeds; no perennial grasses observed during the study.

Landscape plant size. There were no differences in plant sizes attributed to herbicide treatments (data not shown). In general, plant size differences reflected initial size differences, field variations, and faunal disturbances. There were no significant injuries to any nursery and landscape species attributed to treatments. All plants were of saleable quality.

Significance to the Nursery Industry

We believe the nursery industry will benefit from the results of this study. Eight species of nursery and landscape plants were shown to tolerate various application rates of Poast and 2% granular Goal that significantly reduced grass and broadleaf weed cover with single and sequential applications. Use of this combination of herbicides should result in better utilization of labor as well as increased numbers of market quality plants.

(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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