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Phytotoxicity and Nutsedge Control in Woody and Herbaceous Landscape Plants with Manage (MON12037)¹

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Abstract

Manage applied foliarly at 9 and 18 g/ha (0.13 and 0.26 oz/A) provided 87 to 91% purple nutsedge and 79 to 84% yellow nutsedge control. Regrowth measurements taken 5 WAT showed an 88 to 90% reduction in purple nutsedge resprouting and a 75 to 83% reduction in yellow nutsedge resprouting of Manage applied at 9 g/ha and 18 g/ha (0.13 and 0.26 oz/A), respectively. Azalea, redbud photinia, green liriope, white petunias, red petunias, lavender petunias, celosia, vinca, African marigolds, bronze-leaved begonias, and purple salvia tolerated both rates of Manage. Shore juniper, French marigolds, red salvia, geranium, and green-leaved begonias exhibited >10% injury 4 WAT with Manage.

Index words: sulfonylurea herbicide, nutsedge control, herbicide tolerance.

Species used in this study: ageratum (*Ageratum houstonianum* Mill 'Hawaii Blue'); azalea (*Rhododendron indicum* x 'Macrantha Orange'); bronze-leaved begonias (*Begonia semperflorens* Hort.); green-leaved begonias (*B. semperflorens* Hort.); celosia (*Celosia plumosa* Burv.); geranium (*Pelargonium x hortorum* Bailey 'Elite Scarlet'); shore juniper (*Juniperus x conferta* Parl.); green liriope (*Liriope muscari* Bailey); African marigolds (*Tagetes erecta* L. 'Discovery Orange'); French marigolds (*Tagetes patula* L. 'Dwarf Orange'); purple nutsedge (*Cyperus rotundus* L.); yellow nutsedge (*Cyperus esculentus* L.); lavender petunias (*Petunia x hybrida* Juss. 'Orchid Madness'); red petunias (*P. x hybrida* Juss. 'Red Madness'); white petunias (*P. x hybrida* Juss.); redbud photinia (*Photinia x fraseri* Lindl.); purple salvia (*Salvia splendens* L. 'Empire Purple'); red salvia (*S. splendens* L. 'Red Hot Sally'); vinca (*Vinca roseus* L. 'Peppermint Cooler').

Herbicide used in this study: Manage [MON12037 (halosulfuron*)], Methyl 5-[[[(4,6-dimethoxy-2-pyrimidinyl)amino]-carbonylamino]sulfonyl]-3-chloro-1-methyl-1-*H*-pyrazole-4-carboxylate. * Proposed common name.

Significance to the Nursery Industry

The two currently labeled herbicides registered for control of emerged nutsedge in nursery crops have only limited utility in that they must be post-directed in most landscape/nursery species due to their phytotoxicity. Foliar applications of Manage provided 87 to 91% purple nutsedge control and 79 to 84% yellow nutsedge control at 9 and 18 g/ha (0.13 and 0.26 oz/A), respectively. Additionally, Manage provided suppression of tuber regrowth that is essential for nutsedge control. A wide range of herbaceous and woody landscape plants displayed tolerance to Manage. If registered for use on landscape and nursery plants, Manage will provide growers with a selective postemergence herbicide that will control nutsedge in nursery crops.

Introduction

Yellow and purple nutsedge are two of the world's worst weeds (6). In Georgia, yellow and purple nutsedges are among the most troublesome and common weeds in container-grown nursery crops (3). The aggressiveness and wide distribution of yellow and purple nutsedge can be attributed to vegetative propagation by rhizomes and tubers (2). Nutsedge seeds and tubers can be distributed by the transport of contaminated crops or tillage and harvesting equipment, water and wind dispersal, and in the digestive tract of foraging animals (2). Some nutsedge infestations result from contaminated pine bark or soil that is used for a potting medium (11).

Currently, foliar-applied herbicide options for landscape and nursery usage in the control of nutsedge is limited (5). Sulfonylureas are a new class of herbicides that are effective on a broad spectrum of weeds at low rates. Sulfonylureas such as chlorimuron and bensulfuron-methyl are labeled for nutsedge control in soybeans [*Glycine max* (L.) Merr.], peanuts (*Arachis hypogaea* L.), and rice (*Oryza sativa* L.). Chlorimuron is an effective agent for nutsedge control and ornamentals show considerable tolerance (4, 5, 9, 10). The success of chlorimuron for nutsedge control in woody ornamentals has encouraged further ornamental tolerance studies to other sulfonylurea herbicides. MON12037 (proposed common name, halosulfuron) is an experimental sulfonylurea herbicide manufactured by Monsanto. MON12037 will be labeled for use in corn under the trade name of Permit and in turfgrass under the trade name of Manage. Several cool- and warm-season turfgrasses as well as corn (*Zea mays* L.) have exhibited tolerance to MON12037 (1, 7). In addition to excellent control of yellow and purple nutsedge, Manage has shown suppression of green kyllinga (*Kyllinga brevifolia* Rottb.), wild garlic (*Allium vineale* L.), and wild onion (*Allium canadense* L.) (1).

The objective of this research was to evaluate Manage for yellow and purple nutsedge control in four container-grown ornamentals and several bedding plant taxa.

Materials and Methods

Plant materials were potted in ground pine bark amended with 1.4 kg (3.1 lb) gypsum lime, 5.5 kg (12.1 lb) dolomitic limestone, and 3.7 kg (8.2 lb) Sierrablend 17N-6P-10K 8 to 9 month slow release fertilizer (1.5% Ca, 1.0% Mg, 4.0% S, 0.02% B, 0.05% Cu, 0.4% Fe, 0.1% Mn, 0.001% Mo, and 0.05% Zn) per cubic meter. Yellow and purple nutsedge tubers were obtained from Azlin Seed Service (Azlin, MS)

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and were germinated with moist potting soil in an open flat. The germinated tubers were transplanted (one tuber per cup) into 473 ml (16 oz) styrofoam cups with drain-holes. Landscape, bedding, and nutsedge plants were grown in a controlled environment greenhouse at 32/24°C (90/75°F) with 12 hours supplemental lighting (1500 µE/m²/s). Azaleas were purchased in #1 (3.8 l) (1 gal) containers. Juniper and photinia liners were transplanted into #1 (3.8 l) (1 gal) containers containing the pine bark medium. Bedding plants were purchased in cell packs and transplanted into 0.5 l (0.13 gal) containers containing pine bark medium. Nutsedge plants were treated at an average plant height of 10 to 15 cm (4 to 6 in). Plants were treated after root establishment (8 weeks for azaleas and 12 weeks after transplanting for juniper and photinia). The average height of the ornamentals at the time of treatment was: 30 cm (12.0 in) azalea, 35 cm (14.0 in) photinia, 20 cm (8.0 in) (length) juniper, 25 cm (10.0 in) (length) liriopse, 8 cm (3.2 in) French marigolds, 10 cm (4.0 in) African marigolds, 14 cm (5.6 in) white petunias, 9 cm (3.6 in) red petunias, 18 cm (7.2 in) lavender petunias, 9 cm (3.6 in) ageratum, 10 cm (4.0 in) celosia, 11 cm (4.4 in) vinca, 8 cm (3.2 in) bronze-leaved begonias, 7 cm (2.8 in) green-leaved begonias, 17 cm (6.8 in) purple salvia, 12 cm (4.8 in) red salvia, and 11 cm (4.4 in) geraniums. Manage was foliarly applied at 9 and 18 g/ha (0.128 and 0.256 oz/A). The herbicide was sprayed in an enclosed spray chamber calibrated for 187 l/ha (20 gal/A) water at 138 kPa (20 PSI) and a 8004E (TeeJet, Spraying Systems Co., Wheaton, IL 60188) even flat-fan nozzle tip. All spray mixtures included a non-ionic surfactant, X-77 (Valent U. S. A. Corp., Walnut Creek, CA 94596) (0.25% v per v). The treated plants and controls were returned to the glasshouse after application and watered daily beginning no sooner than 12 hr after treatment. Nutsedge fresh shoot weights were taken 4 weeks after treatment (WAT). Yellow and purple nutsedge control was based on fresh shoot weight reduction as a percent of control 4 WAT. Evaluation of tuber resprouting was taken 5 WAT. Crop injury was based on shoot growth reduction as a percent of the control mean. The flowering habits of the treated azaleas were monitored for a 13 week period beginning with the onset of flowering. After azalea bloom initiated, weekly bloom counts were taken from 8 WAT to 20 WAT. Visual estimates of bedding plant injury were taken 4 WAT. The study utilized a randomized complete block design with four replications repeated twice in time. Data were subjected to an analysis of variance and means were separated by Fisher's Protected Least Significance Difference test at the 0.05 level.

Table 1. Fresh shoot weight reduction and regrowth reduction of yellow and purple nutsedge treated with Manage.

Treatment ^a	Rate	Yellow nutsedge		Purple nutsedge	
		Fresh weight	Regrowth ^b	Fresh weight	Regrowth
		4 WAT ^c	5 WAT	4 WAT	5 WAT
	(g/ha) (oz/A)	----- (% reduction) -----			
Check	—	0	0	0	0
Manage	9	79	75	87	88
Manage	18	84	83	91	90
LSD (0.05)		28	25	15	25

^aPlants were allowed to grow for 7 days following the 4 WAT harvest.

^bWAT = Weeks after treatment.

^cX-77 non-ionic surfactant added to all Manage treatments at 0.25% v per v.

Results and Discussion

Manage controlled 87 and 91% of purple nutsedge and 79 and 84% yellow nutsedge control (4 WAT) at 9 and 18 g/ha (0.13 and 0.26 oz/A), respectively (Table 1). These results are similar to the 85 to 99% yellow and purple nutsedge control in turfgrass, as noted by Jackson et. al., with much higher rates (35, 69, and 138 g/ha) of Manage (8). Regrowth measurements taken 5 WAT indicated a 75 to 83% reduction in yellow nutsedge resprouting and an 88 to 90% reduction in purple nutsedge resprouting with Manage applied at 9 g/ha and 18 g/ha (0.13 and 0.26 oz/A), respectively. A rate response was not seen between Manage applied at 9 and 18 g/ha (0.13 and 0.26 oz/A).

Visual injury was not observed in 10 of the 17 nursery/landscape taxa treated with either rate of Manage (Tables 2–4). Neither the azalea nor the redtip photinia exhibited any growth reduction or visual injury (visual injury data not shown). Published data on Manage applied to landscape and nursery crops is not available presently, but other researchers have reported azalea (4, 5, 9, 10) and photinia (4, 5) tolerance to another sulfonyleurea herbicide, chlorimuron. There was no difference in the number of open flowers, flower quality, or flower size on the treated azaleas (data not shown). Growth reductions (< 22%) were observed with the juniper. By 12 WAT, significant growth reductions in juniper were not detected at 9 g/ha (0.13 oz/A). However, growth reductions (17%) occurred at 18 g/ha (0.26 oz/A) 14 WAT. Liriopse growth reduction or visual injury (data not shown) did not occur at either rate 4 WAT.

Table 2. Height reduction of container-grown azalea, photinia, juniper, and liriopse treated with Manage.

Treatment	Rate	Azalea			Photinia			Juniper			Liriopse	
		Weeks after treatment			Weeks after treatment			Weeks after treatment			Weeks after treatment	
		4	8	12	4	8	12	4	8	12	14	4
	(g/ha) (oz/A)	----- (% reduction) -----										
Check	—	0	0	0	0	0	0	0	0	0	0	0
Manage ^a	9	10	7	0	5	0	0	22	19	5	7	0
Manage	18	6	1	0	9	0	2	15	19	19	17	10
LSD (0.05)		ns	ns	ns	ns	ns	ns	18	16	16	15	ns

^aX-77 non-ionic surfactant added to all Manage treatments at 0.25% v per v.

Table 3. Height reduction of bedding plants 4 weeks after treatment treated with Manage.

Treatment	Rate		French marigold	African marigold	Ageratum	Green-leaved begonia	Red Salvia	Geranium
	(g/ha)	(oz/A)	----- (% reduction) -----					
Check	—	—	0	0	0	0	0	0
Manage ^z	9	0.13	0	0	0	37	9	41
Manage	18	0.26	0	0	10	41	31	46
LSD (0.05)			ns	ns	ns	18	11	40

^zX-77 non-ionic surfactant added to all Manage treatments at 0.25% v per v.

Table 4. Overall quality reduction based on appearance 4 weeks after treatment with Manage.

Treatment	Rate		French marigold	African marigold	Ageratum	Green-leaved begonia	Red Salvia	Geranium
	(g/ha)	(oz/A)	----- (% reduction) -----					
Check	—	—	18	0	3	0	0	3
Manage ^z	9	0.13	0	5	38	35	5	68
Manage	18	0.26	23	8	53	33	3	45
LSD (0.05)			12	6	22	27	ns	61

^zX-77 non-ionic surfactant added to all Manage treatments at 0.25% v per v.

Eight of the thirteen bedding plant taxa tested were tolerant (< 10% injury) to Manage even at the highest use rate (Tables 3 and 4). Growth reduction or visual injury was not measurable 4 WAT for the red, white, or lavender petunias, celosia, vinca, bronze-leaved begonias, or purple salvia species tested. However, geraniums and green-leaved begonias received > 30% visual injury and growth reductions following treatment with either rate of Manage. Manage caused 38 and 53% visual injury to ageratum with the 9 and 18 g/ha (0.13 and 0.26 oz/A), respectively. However, growth reductions did not occur 4 WAT. Manage applied at 18 g/ha (0.26 oz/A) caused 23% and 8% visual injury to French and African marigolds, respectively. Red salvia incurred growth reductions after Manage was applied at 18 g/ha (0.26 oz/A). These plants did not appear to have foliar damage.

(Ed. note: This paper reports the results of research only and does not imply registration of a pesticide/herbicide under amended FIFRA. Before using any of the products mentioned in this research report, be certain of their registration by appropriate state and/or federal authorities.)

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