Summer Annual and Winter Annual Weed Control in Field Soil and Soilless Media with Gallery (Isoxaben)[1]

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Abstract

Field and container experiments were conducted to evaluate Gallery (isoxaben) efficacy on several common nursery and landscape weeds. Gallery was applied at rates from 0.14 to 1.1 kg ai/ha (0.125 and 1 lb ai/A). Annual grass control with Gallery generally was poor at application rates below 0.84 kg/ha (0.75 lb/A). Higher rates were needed for consistent foxtail and annual bluegrass control. Gallery controlled most broadleaf weeds at ≤0.56 kg/ha (0.5 lb/A) in field soil and a soilless potting medium. The exception was velvetleaf, which was not controlled with 1.1 kg/ha (1 lb/A). Combining Gallery with Surflan (Snapshot) at 1.1 + 3.4 kg/ha (1 + 3 lb/A) provided excellent control of all weeds tested. Equivalent weed control was obtained with a tank mix of Gallery plus Surflan at 0.28 + 3.4 kg/ha (0.25 + 3 lb/A) in 1989, suggesting that when used in combination with Surflan the rate of Gallery may be reduced relative to the comparable Snapshot rate, without sacrificing weed control.

Index words: Container-grown nursery crops, field-grown nursery crops, herbicides, oryzalin, oxadiazon, oxyfluorfen, simazine, weed control

Weed species used in this study: velvetleaf (*Abutilon theophrasti* Medik.); tumble pigweed (*Amaranthus albus* L.); smooth pigweed (*Amaranthus hybridus* L.); Powell amaranth (*Amaranthus powelli* S.Wats.); lambsquarters (*Chenopodium album* L.); horseweed (*Conyza canadensis* (L.) Cronq.); smooth crabgrass (*Digitaria ischaemum* Schreb. ex Schweig. Schreb. ex Muhl.); large crabgrass (*Digitaria sanguinalis* (L.) Scop.); goosegrass (*Eleusine indica* (L.) Gaertn.); annual bluegrass (*Poa annua* L.); common groundsel (*Poa annua* L.); green foxtail (*Setaria viridis* (L.) Beauv.); wild mustard (*Sinapis arvensis* L.); common chickweed (*Stellaria media* (L.) Vill.); dandelion (*Taraxacum officinale* Weber in Wiggers).

Herbicides used in this study: Gallery (isoxaben), N-[3-(Ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide; Princep (simazine), 2-chloro-4,6-bis(ethylamino)-s-triazine; Ronstar (oxadiazon), 3-[2,4-dichloro-5-(methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one; Rout (oxyfluorfen), 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene, plus (oryzalin) 3,5-dinitro-N^4,N^4-dipropysulfanilamide; Snapshot DF (isoxaben + oryzalin); Surflan (oryzalin).

Significance to the Nursery Industry

Gallery 75DF provided excellent control of most annual broadleaf weeds at rates of ≤ 0.28 kg/ha (0.25 lb/A) in field tests. Velvetleaf was not controlled at 1.1 kg/ha (1 lb/A). In a soilless potting mix, Gallery 1G at 0.56 kg/ha (0.5 lb/A) was superior to labeled standards for broadleaf weed control. In both cropping situations, field and container production, Gallery must be combined with a grass control herbicide such as Surflan to broaden the spectrum of weeds controlled. While the premix, Snapshot DF, provided excellent grass and broadleaf weed control at recommended rates, equivalent control was obtained with a tank mix containing the same rate of Surflan plus one-fourth as much Gallery. Further research should be conducted to evaluate the longevity of control with such mixes and the conditions under which lower rates may breakdown or be inadequate. However, when Gallery is mixed with Surflan it appears to be possible to reduce the rate of Gallery without sacrificing weed control.

Introduction

Gallery has been shown to provide excellent preemergent broadleaf weed control in field-grown trees, shrubs, and woody ground covers (2, 4, 7). In nursery crops and orchards, Colbert and Ford (2) obtained ≥ 90% control of many broadleaf weeds including pigweeds, lambsquarters, common chickweed, common groundsel, and others, with 0.84 to 1.1 kg/ha (0.75 to 1 lb/A) Gallery. However, in small grains weed control trials and seeded weed studies, these and other weeds were controlled with much lower rates. Pigweed was controlled with 0.04 kg/ha (0.036 lb/A) Gallery (8), as was common chickweed (9). In small grains, lambsquarters, common chickweed, and common groundsel were controlled with ≤ 0.15 kg/ha (≤ 0.13 lb/A) (3, 5). Other weeds in the *Asteraceae* (composite family), *Brassicaceae* (mustard family), *Lamiaceae* (mint family), *Scrophulariaceae* (figwort family), *Caryophyllaceae* (pink family), and *Polygonaceae* (buckwheat family) have also been controlled with ≤ 0.15 kg/ha (0.13 lb/A) in small grains (1, 3, 5). These data suggest that the rates used for weed control in nursery crops could be reduced. These tests should be conducted in the absence of a competitive crop, such as small grains, to ensure the applicability to nursery production situations.

Control of grasses has been inconsistent with Gallery. Parker and Wilson (8) reported excellent control of large crabgrass with 0.16 kg/ha (0.14 lb/A) and goosegrass control with 0.64 kg/ha (0.57 lb/A); however, poor grass control has been reported with Gallery. Richardson and West (9) reported that several grass crops and grassy weeds were not controlled by 0.64 kg/ha (0.57 lb/A) of Gallery. Others have

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reported Gallery to be weak on annual grasses (2, 4, 7). Consequently, overall weed control was improved by combining Gallery with a grass control herbicide such as Surflan (4, 7). The premixed combination product, Snapshot DF, contains a 1 to 3 ratio of Gallery to Surflan. This mixture provided excellent grass and broadleaf weed control at rates equivalent to 0.84 kg/ha Gallery plus 2.5 kg/ha Surflan (0.75 plus 2.25 lb/A, respectively). Considering the rates of Gallery required to control broadleaf weeds in small grains, it may be possible to reduce the Gallery rate in the Snapshot mixture and still provide excellent weed control.

Gallery and Snapshot have also been shown to be safe on container-grown woody nursery crops (7). However, there are no published reports of Gallery efficacy in soilless container mixes.

The objectives of this research were (a) to evaluate reduced rates of Gallery, alone and in combination with Surflan, for control of common nursery weeds, and (b) to evaluate Gallery efficacy in a soilless container mix.

Materials and Methods

Field experiments. Seeded "weed nursery" tests were conducted in 1988 and 1989 at Cornell University, Ithaca, NY. The soil type was a Hudson silty clay loam (fine-illitic, mesic Glossaquic Hapludalf). Weed seed were collected from native populations or purchased from seed suppliers, and stored at 4°C (39°F) for several months to break any dormancy requirements. Weeds tested were crabgrass (large crabgrass in 1988 and a mixture of large and smooth crabgrass in 1989), green foxtail, goosegrass, lambsquarters, velvetleaf, common groundsel, dandelion, and three pigweed species. In 1988, the pigweeds were tumble pigweed and smooth pigweed. In 1989, smooth pigweed and Powell amaranth were included. The soil was cultivated then cultipacked. Weed seed were copiously seeded into the small cultipacker furrows, then lightly raked to mix the seed with the soil. Rows of individual weed species were 0.6 m (2 ft) apart. Seeding dates were May 31, 1988 and May 4, 1989. Herbicide treatment dates were June 3, 1988 and May 9, 1989. Herbicides were applied across the weed rows with a CO_2 pressurized backpack sprayer equipped with flat fan nozzles and calibrated to deliver 280 L/ha (30 GPA) at 276 kPa (40 psi). Plot size was 1 meter (40 in) wide by 7.6 meters (25 ft) long. Treatments were applied in a randomized complete block design with three or four replicates.

Chemical treatments in 1988 were Gallery 75% dry flowable 75DF), Snapshot 80% dry flowable (80DF) (20% Gallery + 60% Surflan), and Surflan (4AS) (0.48 kg/liter (4 lb/gal) aqueous suspension). In 1989, lower rates of Gallery were applied alone and in combination with Surflan. Application rates are presented in Tables 1 and 2.

Percent weed control was visually evaluated 8 weeks after treatment in 1988, and 7 and 12 weeks after treatment in 1989. Data were subjected to analysis of variance; means were separated using a Bayesian least significant differences procedure (SAS Institute, Inc., Cary, NC). Gallery rate responses were subjected to linear regression analysis, PROC REG.

Container experiments. Container weed control tests were conducted in 1988 and 1989 at the Cornell University Long Island Horticultural Research Laboratory, Riverhead, NY. One-liter (1-qt) pots were filled with a soilless "peat-lite" medium then treated with granular herbicides on September 7, 1988 and September 27, 1989. Herbicides included Gallery 1% granule (1G), Ronstar 2% granule (2G), Rout 2 + 1G (2% oxyfluorfen + 1% oryzalin), and Princep 4% granule (4G) (1989 only). Herbicide rates are presented in Table 3. Pots received about 2 cm (0.75 in) of irrigation after treatment. One day after treatment, weed seed were spread over the treated pots, 3 pots per species per treatment. Each experiment was replicated 4 times in a randomized complete block design. Pots were irrigated after seeding and every other day thereafter. The weed species were common chickweed, wild mustard, horseweed, common groundsel, dandelion, and annual bluegrass.

Percent weed control was evaluated about 1 month after treatment in 1988 and 1989, and again 2 months after treatment in 1989. Data were subjected to analysis of variance and means were separated using a Bayesian least significant differences procedure.

Table 1. Field Weed Control 8 Weeks After Treatment with Gallery and Snapshot, 1988.

Herbicide	Rate (kg/ha)	Weed control, by species								
		DIGSA[z]	SETVI	ELEIN	AMAAL	AMAHY	ABUTH	CHEAL	SENVU	TAROF
		(%)								
None	—	7	0	0	0	0	0	0	0	12
Gallery	0.56	80	80	80	100	87	70	93	92	100
Gallery	0.84	92	80	90	97	88	40	100	97	100
Gallery	1.1	90	80	100	93	100	60	95	93	98
Snapshot DF	0.84 + 2.5[y]	100	95	100	100	100	80	98	100	100
Snapshot DF	1.1 + 3.4	100	97	100	100	100	100	100	100	100
Surflan	3.4	100	98	100	100	50	40	90	30	93
LSD (0.05)		12	13	11	8	32	35	11	23	30
Linear regression analysis: Gallery rate response[x]		NS	NS	0.06	NS	NS	NS	NS	NS	NS

[z]Weed Sci. Soc. Amer. approved computer codes for large crabgrass (DIGSA), green foxtail (SETVI), goosegrass (ELEIN), tumble pigweed (AMAAL), smooth pigweed (AMAHY), velvetleaf (ABUTH), lambsquarters (CHEAL), common groundsel (SENVU), and dandelion (TAROF).

[y]Rates for Snapshot DF are in kg/ha of each component, isoxaben + oryzalin.

[x]Probability values associated with the linear regression analysis of Gallery rate response. NS = nonsignificant at the 10% level of confidence.

Table 2. Field Weed Control 15 Weeks After Treatment With Gallery and Snapshot, 1989.

Herbicide	Rate (kg/ha)	Weed control, by species								
		DIGxx[z]	SETVI	ELEIN	AMAHY	AMAPO	ABUTH	CHEAL	SENVU	TAROF
		(%)								
None	—	0	0	0	5	13	0	5	0	0
Gallery	0.14	15	50	35	85	99	15	95	68	80
Gallery	0.28	40	65	38	95	100	13	99	93	95
Gallery	0.56	58	88	80	100	100	48	100	98	100
Gallery	0.84	88	85	100	100	100	73	100	100	98
Gallery + Surflan	0.28 + 3.3	100	100	100	97	100	98	100	100	94
Snapshot DF	1.1 + 3.3[y]	100	100	100	100	100	100	100	100	100
Surflan	3.3	100	100	100	99	99	100	98	80	90
LSD (0.05)		27	23	23	12	13	24	6	20	13
Linear regression analysis: Gallery rate response[x]		0.003	0.02	0.001	NS	NS	0.007	NS	0.09	NS

[z]Weed Sci. Soc. Amer. approved five letter codes for crabgrass (DIGXX, a mixture of large and smooth), green foxtail (SETVI), goosegrass (ELEIN), smooth pigweed (AMAHY), Powell amaranth (AMAPO), velvetleaf (ABUTH), lambsquarters (CHEAL), common groundsel (SENVU), and dandelion (TAROF).

[y]Rates for Snapshot DF are in kg/ha of each component, isoxaben + oryzalin.

[x]Probability values associated with the linear regression analysis of Gallery rate response. NS = nonsignificant at the 10% level of confidence.

Results and Discussion

Field experiments. In 1988, 0.56 kg/ha (0.5 lb/A) Gallery controlled all broadleaf weeds except velvetleaf, which was not adequately controlled even at 1.1 kg/ha (1 lb/A) (Table 1). Control of broadleaf weeds was not affected by Gallery rate (Table 1). In 1989, when lower rates of Gallery were tested, lambsquarters and Powell amaranth were controlled with 0.14 kg/ha (0.125 lb/A), while smooth pigweed, groundsel, and dandelion required 0.28 kg/ha (0.25 lb/A) (Table 2). These rates are only slightly higher than those reported to control these species in small grains (3, 5). Again, velvetleaf was not controlled by Gallery in 1989, although control improved linearly with increasing rate (Table 2). This observation is contrary to label information which claims velvetleaf control at 1.1 kg/ha (1 lb/A). In previous research, common mallow (*Malva neglecta*), a weed in the same family as velvetleaf (the *Malvaceae*), was not controlled with 1.1 kg/ha (1 lb/A) (6).

Higher rates of Gallery were required for annual grass control than for broadleaf weed control. Goosegrass control improved with increasing rates of Gallery but crabgrass and foxtail control was not significantly improved by rates higher than 0.56 kg/ha (0.5 lb/A) (Table 1). In 1989, the rate responses for crabgrass, foxtail and goosegrass were linear, with good to excellent control of all 3 species at 0.84 kg/ha (0.75 lb/A) for each species (Table 2).

Surflan provided essentially 100% grass control each year. In 1988, Surflan also controlled tumble pigweed, lambsquarters and dandelion, but not smooth pigweed, velvetleaf or groundsel (Table 1). In 1989, Surflan controlled all weeds except groundsel (Table 2). Snapshot, provided excellent control of all 9 weed species each year (Tables 1 and 2). In 1989, the tank mix of 0.28 kg/ha (0.25 lb/A) Gallery plus 3.4 kg/ha (3 lb/A) Surflan (one-fourth of the Gallery rate in Snapshot) also provided complete control of all 9 weed species. These data support our hypothesis that when used in combination with Surflan, the rate of Gallery may be reduced relative to the ratio in Snapshot.

Container experiments. As observed in the field tests, Gallery provided excellent control of the broadleaf weeds

Table 3. Weed Control in Containers with Granular Herbicides.

Herbicide	Rate (kg/ha)	Weed Control, 1988						Weed Control, 1989					
		STEME[z]	SINAR	ERICA	SENVU	TAROF	POAAN	STEME	SINAR	ERICA	SENVU	TAROF	POAAN
		(%)											
None	—	0	0	0	0	0	0	0	0	0	0	0	0
Gallery	0.56	99	100	98	100	100	73	100	90	100	92	98	65
Gallery	1.1	100	100	100	96	100	96	100	100	100	97	100	79
Ronstar	2.2	0	60	49	59	100	94	0	83	100	95	98	100
Ronstar	4.5	20	98	88	89	96	100	3	83	100	98	100	100
Rout	2.2 + 1.1	98	100	100	91	100	98	25	51	66	45	85	95
Princep	1.1	—	—	—	—	—	—	28	48	31	19	64	65
LSD (0.05)		25	25	26	26	12	10	27	35	36	33	20	20

[z]Weed Sci. Soc. Ameri. approved computer codes for common chickweed (STEME), wild mustard (SINAR), horseweed (ERICA), common groundsel (SENVU), dandelion (TAROF), and annual bluegrass (POAAN).

with 0.56 kg/ha (0.5 lb/A) (Table 3). Lower rates were not tested. Chickweed, wild mustard, horseweed, groundsel, and dandelion control was equal or superior to Rout, Ronstar, or Princep. At 0.56 kg/ha (0.5 lb/A), Gallery provided poor control of annual bluegrass (Table 3). In 1988, 1.1 kg/ha (1 lb/A) Gallery controlled annual bluegrass but in 1989 poorer control was observed at both rates.

Ronstar controlled annual bluegrass, dandelion, wild mustard, horseweed, and groundsel at 4.5 kg/ha (4 lb/A) but not common chickweed. In 1988 Rout controlled all 6 weeds but in 1989, Rout was less effective on chickweed, wild mustard, horseweed, and groundsel than Gallery (Table 3). Princep, included in 1989 only, provided poor control of chickweed, wild mustard, horseweed, and groundsel, and about 65% control of dandelion and annual bluegrass (Table 3).

(**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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