Herbicides for Control of Wild Garlic in Turfgrass

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SUMMARY. Wild garlic (*Allium vineale*) is an annual winter weed in managed turfgrass. Its dark green, upright stems are easily distinguishable among low-lying, dormant warm-season grasses. Experiments were conducted to determine the effectiveness of synthetic auxin and acetolactate synthase (ALS) inhibiting herbicides for post-emergence control of wild garlic. Trials were conducted in 2016 and 2017. Throughout both trial years, synthetic auxin herbicides exhibited visual control quicker than ALS inhibitors at the initial assessment date 20 d after application (DAA). Conversely, at the final assessment date 49 DAA, ALS inhibitors were the only treatments that controlled wild garlic by more than 85%. In 2016, plots treated with 2,4-D + dicamba + mecoprop at 4 pt/acre exhibited 88% visual control when assessed 20 DAA, but this level had decreased to 51% by 49 DAA. Similarly, visual control in plots treated with 2,4-D + mecoprop + dicamba + carfentrazone-ethyl at 4 pt/acre decreased from 59% to 56% and 82% to 18% between assessment dates in 2016 and 2017, respectively. Metsulfuron-methyl at 0.5 fl oz/acre controlled wild garlic 94% and 91% at the 49 DAA assessment date, whereas sulfentrazone + metsulfuron-methyl at 0.41 lb/acre controlled wild garlic 93% and 95% at the same assessment dates in 2016 and 2017, respectively. Future research should consider tank mixes of auxin-mimicking and ALS-inhibiting herbicides as potential routes for quick burndown and season-long control.

Wild garlic, a plant native to Europe, is a troublesome turfgrass weed throughout the southeastern United States. A member of the lily family (*Liliaceae*), the dark green color of this plant stands out among warm-season turfgrass species during winter dormancy periods. Wild garlic is a monocot that is morphologically characterized as an erect perennial herb that can grow up to 90 cm in height (Bryson and DeFelice, 2009). Shoots are hollow and rounded and release a distinct alliaceous, or “garlicky,” odor upon crushing or cutting.

Despite its prominence as a weed in maintained turfgrass, published research pertaining to wild garlic control has been somewhat limited.

Synthetic auxin chemistries, including 2,4-D, have been used to control wild garlic (Davis et al., 1962). Auxins are not always safe to sensitive turfgrass species, particularly st. augustinegrass (*Stenotaphrum secundatum*) and centipedegrass (*Eremochloa ophiuroides*) (Kelly and Coats, 2000; Ni et al., 2006).

Nonselective herbicides have also proven useful for control of wild garlic. Glyphosate either equaled or surpassed control achieved by 2,4-D in studies by Hardcastle (1976) and Troutman et al. (1981). However, glyphosate applications are limited to warm-season species, such as bermudagrass (*Cynodon dactylon*) and zoysiagrass (*Zoysia japonica*), during winter dormancy. Peters and McKelvey (1982) found that spring

applications of paraquat in kentucky bluegrass (*Poa pretensis*) sod at a rate of 0.56 kg·ha⁻¹ consistently controlled wild garlic; however, paraquat is not labeled for use in turfgrass. The acetolactate synthase-inhibiting herbicides, such as metsulfuron (Leys and Slife, 1987), chlorsulfuron (Ferrell et al., 2004; Leys and Slife, 1982, 1986; Patton et al., 2008), and imazethapyr (Ferguson et al., 1992), provide acceptable visual control of wild garlic ranging from 85% to 95%. Likewise, thifensulfuron controlled wild garlic >90% in soft red winter wheat (*Triticum aestivum*) and reduced the viability of bulbs produced (Gast et al., 1990).

Prior literature on this subject largely ignores common applications in maintained turfgrass scenarios. Our objective for this study was to further evaluate commonly applied turfgrass herbicides for wild garlic efficacy.

Materials and methods

A research study, designed as a randomized complete block with four replications, was conducted near Starkville, MS, at the H.H. Leveck Animal Research Center during Winter 2016 and at the Rodney R. Foil Plant and Soil Science Research Center located near Starkville, MS, during Winter 2017. Treatments (Table 1) included nine common postemergence herbicides and a nontreated check. All were applied with a handheld, carbon dioxide (CO₂)-pressurized backpack sprayer in a water carrier volume of 20 gal/acre. Experimental units were 5 × 10 ft. Herbicide applications occurred on 26 Feb. 2016 and 13 Jan. 2017 and were made when possible, based on rainfall and wild garlic growth. All treatments included 0.25% v/v nonionic surfactant (Preference; WinField Solutions, St. Paul, MN). Nonionic surfactant was included to increase herbicide

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Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
73.0778	fl oz/acre	mL·ha ⁻¹	0.0137
0.3048	ft	m	3.2808
9.3540	gal/acre	L·ha ⁻¹	0.1069
1.1209	lb/acre	kg·ha ⁻¹	0.8922
0.1198	lb/gal	kg·L ⁻¹	8.3454
70.0532	oz/acre	g·ha ⁻¹	0.0143
1.1692	pt/acre	L·ha ⁻¹	0.8553

Table 1. Common turfgrass herbicides evaluated for control of wild garlic.

Active ingredient	Rate (per acre a.i.) ^z	Rate (g·ha ⁻¹ a.i.) ^z	Trade name	Manufacturer	Formulation ^y
Nontreated check	—	—	—	—	—
Sulfosulfuron	2 oz	105	Certainty	Valsent USA Corp., Walnut Creek, CA	75%
Imazaquin	11.4 fl oz	560	Image	Central Garden and Pet Co., Walnut Creek, CA	70%
Halosulfuron	1.33 oz	70	Sedgehammer	Gowan Co., Yuma, AZ	75%
Metsulfuron-methyl	0.5 oz	21	MSM Turf	Control Solutions, Pasadena, TX	60%
Trifloxysulfuron	0.53 oz	28	Monument	Syngenta Crop Protection, Greensboro, NC	75%
Sulfentrazone + metsulfuron-methyl	0.41 lb	300	Blindside	FMC Corp., Philadelphia, PA	66%
2,4-D, dicamba, mecoprop	4 pt	1520	Trimec Classic	PBI Gordon Corp., Kansas City, MO	2.72 lb/gal
2,4-D, dicamba, penoxsulam, sulfentrazone	4 pt	450	Avenue South	PBI Gordon Corp.	0.80 lb/gal
2,4-D, mecoprop, dicamba, carfentrazone-ethyl	4 pt	454	Speedzone Southern	PBI Gordon Corp.	0.81 lb/gal

^zAll treatments included a nonionic surfactant at a rate of 0.25% by volume; 1 oz/acre = 70.0532 g·ha⁻¹, 1 fl oz/acre = 73.0778 mL·ha⁻¹, 1 lb/acre = 1.1209 kg·ha⁻¹, 1 pt/acre = 1.1692 L·ha⁻¹, and 1 g·ha⁻¹ = 0.0143 oz/acre.

^y1 lb/gal = 0.1198 kg·L⁻¹.

contact on the waxy leaf structure of wild garlic plants. Visual injury was assessed on a 0 to 100% scale, with 0% representing no control and 100% representing complete weed extermination, 20 and 49 DAA. Data were subject to analysis of variance ($\alpha = 0.05$) using SAS Procedure GLIMMIX mixed model analysis (SAS version 9.4; SAS Institute, Cary, NC). Basic model assumptions were confirmed. A treatment-by-year interaction was significant for both assessment intervals; therefore, data are presented by year. Means were separated using Fisher's protected least significant difference test ($\alpha = 0.05$).

Results

When sites were visually assessed 20 DAA in 2016, all herbicides controlled wild garlic $\geq 50\%$ relative to the nontreated check, suggesting all herbicides included in this study had quick burndown control of wild garlic (Table 2). All treatments controlled wild garlic better than the nontreated check when assessed 49 DAA. Sulfentrazone + metsulfuron-methyl (Blindside; FMC Corp., Philadelphia, PA) (95%) and metsulfuron-methyl (MSM Turf; Control Solutions, Inc., Pasadena, TX) (94%) controlled wild garlic $>90\%$. Sulfosulfuron (Certainty; Valent USA Corp., Walnut Creek, CA), imazaquin (Image; Central Garden and Pet Co., Walnut Creek, CA), and trifloxysulfuron (Monument; Syngenta Crop Protection, Greensboro, NC) were not statistically different from products containing synthetic auxins, 2,4-D + dicamba + mecoprop (Trimec Classic; PBI Gordon Corp., Kansas City, MO), and 2,4-D + mecoprop + dicamba + carfentrazone (Speedzone Southern, PBI Gordon Corp.) exhibited a decrease in visual control between the 20 and 49 DAA rating dates during 2016.

Visual control of wild garlic was much slower to manifest when this trial was repeated in 2017 (Table 2). All treatments with ALS-inhibiting active ingredients failed to control wild garlic greater than the nontreated check when assessed 20 DAA. Only the auxin-mimicking herbicides 2,4-D + dicamba + mecoprop, 2,4-D + dicamba + penoxsulam + sulfentrazone, and 2,4-D + mecoprop + dicamba + carfentrazone-ethyl controlled wild garlic greater than the

Table 2. Effect of herbicide treatments on visual control of wild garlic. Percent visual control rated 20 and 49 d after application (DAA) in 2016 and 2017.

Treatment	2016		2017	
	20 DAA	49 DAA	20 DAA	49 DAA
	Control (%)			
Nontreated check	0 b ^c	0 f	0 d	0 e
Sulfosulfuron	68 a	86 ab	13 d	83 abc
Imazaquin	53 a	81 abcd	9 d	93 a
Halosulfuron	50 a	53 de	33 cd	66 abc
Metsulfuron-methyl	68 a	94 a	29 cd	91 ab
Trifloxysulfuron	66 a	83 abc	40 bcd	98 a
Sulfentrazone + metsulfuron-methyl	65 a	95 a	35 cd	93 a
2,4-D, dicamba, mecoprop	75 a	50 e	88 a	51 cd
2,4-D, dicamba, penoxsulam, sulfentrazone	61 a	64 bcde	69 abc	56 bc
2,4-D, mecoprop, dicamba, carfentrazone-ethyl	59 a	56 cde	82 ab	18 de

^aResults are comparable within year and DAA for each column only. Means followed by the same letter are not significantly different according to Fisher's least significant difference ($\alpha = 0.05$).

nontreated (88%, 69%, and 82%, respectively) at this time. However, when assessed 49 DAA this trend reversed. 2,4-D + dicamba + mecoprop, 2,4-D + dicamba + penoxsulam + sulfentrazone, and 2,4-D + mecoprop + dicamba + carfentrazone all exhibited a decrease in control, while sulfonylurea herbicides imazaquin, metsulfuron-methyl, trifloxysulfuron, and sulfentrazone + metsulfuron-methyl all controlled wild garlic control >91%.

All ALS-inhibiting herbicides were not statistically different from trifloxysulfuron, which provided 98% control.

Discussion

Although data could not be pooled across years, similar trends were observed in both years, pointing to a consistency in product performance overall. Combination products containing synthetic auxins, such as 2,4-D + dicamba + mecoprop, 2,4-D + dicamba + penoxsulam + sulfentrazone, and 2,4-D + mecoprop + dicamba + carfentrazone-ethyl, all achieved quick and significant burn-down control of wild garlic 20 DAA. The decrease, or lack of significant increase, in control as trials progressed in both years from 20 to 49 DAA indicates that these products may not be suitable for long-term wild garlic control. Interestingly, Avenue South provided intermediate control compared with treatments containing a single mode of action.

Trial locations were unmown during the study period, which may have contributed to regrowth

and recovery by auxin treated wild garlic. However, it is not atypical for similarly maintained lawns to be unmown until bermudagrass transitions out of dormancy and requires mowing.

In general, control with treatments containing ALS-inhibiting a.i. was slower to manifest in both years. At the final assessment date in both 2016 and 2017, sulfentrazone + metsulfuron-methyl and metsulfuron-methyl controlled wild garlic >91%. This suggests sulfentrazone + metsulfuron-methyl and metsulfuron-methyl alone may be best for long-term control of wild garlic among products included in this study. This study also suggests that if quick burndown control of wild garlic is desired, reliance on herbicides containing multiple synthetic auxins, such as 2,4-D + dicamba + mecoprop, 2,4-D + dicamba + penoxsulam + sulfentrazone, or 2,4-D + mecoprop + dicamba + carfentrazone-ethyl may be required. This study strengthens the case that imazaquin (Ferrell et al., 2004; Patton et al., 2008) and metsulfuron-methyl (Leys and Slife, 1987) are reasonable control options for wild garlic in turfgrass. Emphasis of future research should be placed on reconciling the quick burndown of synthetic auxin herbicides with the season-long control from ALS-inhibitors. Studies could examine the effectiveness of repeat applications of products such as 2,4-D + dicamba + mecoprop for season-long control of wild garlic. In addition, tank mixes containing both sulfonylurea and auxin-mimicking herbicides should

be tested to explore the possibility of combining these modes of action for quick burndown as well as season-long control.

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