POSTEMERGENCE HERBICIDES FOR THE CONTROL OF GOOSEGRASS IN BERMUDAGRASS TURF

2021 Study report

UF IFAS UNIVERSITY of FLORIDA

100th anniversary

UF/IFAS Turfgrass Science Program

Postemergence herbicides for the control of goosegrass in bermudagrass turf

Pawel Petelewicz[1*], Patrick H. McLoughlin[2], Karen E. Williams[2], and Marco Schiavon[2]

[1]Agronomy Department
University of Florida, Gainesville, FL

[2]Environmental Horticulture Department
University of Florida, Fort Lauderdale Research and Education Center, Davie, FL

[*]*petelewicz.pawel@ufl.edu; date report made public: May 5, 2022*

The Bottom Line: Thirty-four treatments containing commercially available and experimental herbicides were tested alone or in combination against a nontreated control for postemergence control of mature (tillering) goosegrass (*Eleusine indica*) in 'Tifway 419' bermudagrass (*Cynodon* spp.) maintained as golf course fairway. The study was conducted at the Fort Lauderdale Research and Education Center in Davie, FL. The impact of immediate post-herbicide irrigation on Pylex, Pylex + Sencor and UF 01 treatments on turf safety and efficacy against goosegrass was also investigated. Herbicides were applied once or two times (2-wks or 6-wks time intervals) starting June 2021. The highest level of control was observed with Target 6.6 (MSMA) at 40.0 oz/A + Sencor 75% at 6.0 oz/A and Sencor 75% at 4.0 oz/A + Pylex at 0.25 oz/A tank-mixes when not watered-in. It should be noted that MSMA was used as a historical reference and is currently not labeled for use in Florida turfgrass. These treatments provided control greater than the acceptable threshold of 80% at 6 weeks after initial treatment (WAIT) but declined to ~ 65% at 10 WAIT. Other treatments resulting in >80% control at 4 WAIT were Pylex at 0.25 oz/A regardless of irrigation treatment, and non-irrigated tank-mixes of Sencor 75% at 4.0 oz/A + Pylex at 0.15 oz/A and Tenacity at 5.0 oz/A + Princep Liquid 15.0 oz/A + Manuscript 42.0 oz/A. However, these treatments, with the exception of watered-in Pylex at 0.25 oz/A, resulted in rapid and severe phytotoxicity to bermudagrass persisting above the acceptability threshold for 2 to 3 weeks after final application. In general, immediate post-application irrigation reduced phytotoxicity of treatments which it was employed with, however not always to the extent when such injury could be considered acceptable. None of the treatments provided satisfactory goosegrass control at the termination of the study at 10 WAIT. This is presumably due to the maturity of the goosegrass at the time of study initiation and the absence of preemergence treatments both prior and during the study.

Acknowledgments

Thanks to the Florida Golf Course Superintendents Association, Florida Turfgrass Association, Turfgrass Producers of Florida, BASF, Bayer, Syngenta, and all confidential cooperators for the financial support of this research and/or for providing products or other resources.

Introduction

Goosegrass [*Eleusine indica* (L.) Gaertn.] is a difficult-to-control annual grassy weed that becomes increasingly more challenging to eradicate as the plant matures and starts to tiller. It often occurs in compacted soils or heavily trafficked areas, but it is not limited to such. The ban on MSMA use in Florida heavily reduced the number of reliable options for turfgrass managers for goosegrass control in bermudagrass turf. Currently, those options are limited to four main mode of action (MOA) groups which include active ingredients such as metribuzin, topramezone, foramsulfuron, and sulfentrazone.

Moreover, the two latter herbicides are considered to be primarily effective on seedling goosegrass (less than 3 tillers). Continuous and excessive use of a single MOA creates a high selective pressure on target weeds and may lead to the evolution of resistant populations. Goosegrass has a well-documented potential for developing such resistance and to-date there have been multiple reports of resistance to specific sites-of-action in various crops, including turfgrass. Therefore, the identification of efficacious and non-turf injurious postemergence goosegrass control measures is crucial.

Objectives

This study was conducted to evaluate the impact of various herbicides rates and formulations on their ability to control the mature goosegrass populations in 'Tifway 419' bermudagrass maintained as a golf course fairway or athletic field. The impact of immediate post-herbicide irrigation on selected treatments on turf safety was also investigated.

Materials and Methods

The study was conducted in 2021 from June until August at the Fort Lauderdale Research and Education Center (UF/IFAS FLREC, Davie, FL; USDA plant hardiness zone 10b; ca. 9 ft elevation). The turf was mature bermudagrass 'Tifway 419' maintained as a golf course fairway or athletic field on a Hallandale fine sand. Turf was mowed 3 days/wk at 0.5 inches and received 1 lb N/1000 ft^2/month. No preemergence herbicides were applied to the research area in 2021 either during the study, nor prior to its initiation. Target weed was goosegrass with mature (tillering, and in majority of cases producing seedheads) populations prevailing. A total of 35 herbicide treatments (including nontreated control) were applied as described in Table 1 on June 11, June 23 and/or July 23. Non-ionic surfactant (NIS; Induce by Helena) at 0.25% v/v, methylated seed oil (MSO; MSO Concentrate by Loveland) at 0.5% v/v or Adigor (Syngenta) at 0.5% v/v were added to the tank-mix as prescribed by the herbicide treatment. All herbicide treatments were applied using a CO_2-powered backpack sprayer (R&D Sprayers, Bellspray, Inc.) equipped with four TeeJet® 8002VS VisiFlo® flat-fan spray tips (TeeJet Technologies, Spraying Systems Co.) calibrated to deliver 1 gallon/1000 ft^2 of spray solution. Post-herbicide irrigation was applied to chosen treatments as described in Table 1 by hand using a hose calibrated to deliver 0.2 inches immediately following herbicide application. The remaining treatments received no irrigation and/or no precipitation (rain) for at least 6 hours following the application.

Evaluation was carried out on a weekly and/or biweekly schedule, starting on June 10 and ending on August 20, 2021. Plots were visually evaluated for goosegrass cover (0-100%) which was used to expressed control - percentage of ratio between initial cover and cover at the time of evaluation (0-100%), and for turfgrass injury (i.e., phytotoxicity; 0-10, 0 = no damage, 3 = maximum acceptable injury level, 10 = dead turfgrass).

Study design was a complete randomized block (CRB) with 4 replications. Individual plot size was 4×4 ft with no alleys due to the localized target weed distribution. By convention, control ratings of 80% or greater was considered satisfactory control (acceptability threshold) and injury ratings of 3 or lower was considered acceptable (acceptability threshold). Data collected throughout the study was analyzed using analysis of variance in Statistica 10 (StatSoft, Inc.) and the means were compared using the Fischer's protected least significant difference test at the 0.05 probability level.

Results

Overall, best goosegrass control [>90% 4 weeks after initial treatment (WAIT), ≥80% 6 WAIT, and >65% 10 WAIT] was achieved with Target 6.6 at 40.0 oz/A + Sencor 75% at 6.0 oz/A (Trt 27) and Sencor 75% at 4.0 oz/A + Pylex at 0.25 oz/A (Trt 15) tank-mixes when not subjected to immediate post-application irrigation (i.e., not watered-in). It is important to emphasize that MSMA-containing Target 6.6 + Sencor 75% (Trt 27) tank-mix, as well as standalone Target 6.6 (Trt 17) treatments were used in this study only as a historical reference; these are currently not allowed for use in Florida. Other treatments resulting in >80% control at 4 WAIT were Pylex alone at 0.25 oz/A (Trts 9 and 10) regardless if watered-in or allowed to dry, and tank-mixes of Sencor 75% at 4.0 oz/A + Pylex at 0.15 oz/A (Trt 13) and Tenacity at 5.0 oz/A + Princep Liquid 15.0 oz/A + Manuscript 42.0 oz/A (Trt 35) but only when not watered-in. However, a substantial decline in goosegrass control was observed in those treatments (Trts 9, 10, 13, and 35), ultimately resulting in less than satisfactory control (Figure 1, Table 2).

In general, none of the treatments included in this study provided goosegrass control at the acceptable level (≥80% control) at the termination of data collection at 10 WAIT. Typically, except for non-watered-in Sencor 75% at 8.0 oz/A (Trt 21) and Pylex at 0.25 oz/A (Trt 9) treatments, single MOA treatments employed in this study resulted in far below satisfactory level of goosegrass control. Particularly, foramsulfuron-containing treatments were low to entirely non-effective in this study (Figure 2, Table 2). Those phenomena could be attributed to the complexity of this specific research setting. High level of mature target weed populations at the time of study initiation could have resulted in the reduced efficacy of some of the active ingredients used in this study. Absence of preemergence treatments applied to the research area both prior and during the study could have also contributed to the recovery of goosegrass populations. Additionally, foramsulfuron-based products were utilized at this facility as a customary solution to tackle goosegrass infestation prior to this study, thus resistance to ALS-inhibiting herbicides cannot be ruled out until further investigated. Lastly, herbicide applications made in the heat of the summer when water availability to plants is also reduced, and this might have further impeded the efficacy of some treatments. Nonetheless, in most cases the simultaneous applications of multiple MOAs resulted in elevated herbicidal efficacy against goosegrass – especially when individual components were used at lower rates (Figure 3, Table 2).

Overall, the immediate post-application irrigation had confounding effects on the efficacy of several herbicide treatments. Irrigation immediately after treatment resulted in elevated goosegrass control when used with UF 01 (Trts 4 vs 3, 6 vs 5), Sencor 75% at 4.0 oz/A (Trt 8 vs 7) and Pylex at 0.5 oz/A (Trt 12 vs 11), while Pylex alone at 0.25 oz/A (Trt 9 vs 10) was not impacted. Conversely, the efficacy of both Sencor 75% + Pylex tank-mixes (Trts 13 vs 14, 15 vs 16) was significantly reduced when combined with watering-in treatment (Figure 4, Table 2).

Nearly all the aforementioned treatments, resulting in even transiently satisfactory degree of goosegrass control (Trts 9, 13, 15, 27) resulted in rapid and severe phytotoxicity to the bermudagrass persisting at the level above the acceptable threshold for 2 to 3 weeks after final application. The only exception was standalone Pylex at 0.25 oz/A (Trt 10) when immediately watered in (Figure 5, Table 3). In general, immediate post-application irrigation reduced phytotoxicity of treatments which it was employed with, however not always to the extent when such injury could be considered acceptable (Figure 6, Table 3).

Tables and Figures

Table 1. Herbicide treatments and application timings (A – June 11, B – June 23, C - July 23) used in the study to evaluate goosegrass control in bermudagrass 'Tifway 419' maintained as a golf course fairway or athletic field. Non-ionic surfactant (NIS; Induce by Helena) at 0.25% v/v, methylated seed oil (MSO; MSO Concentrate by Loveland) at 0.5% v/v and or Adigor (Syngenta) at 0.5% v/v were added to the tank-mix as prescribed by the herbicide treatment. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL. 2021.

No.	Treatment	Active ingredient	HRAC & WSSA Code	Company	Rate (oz/A)	Post-app. irrigation	No. of apps.	Freq. (wks)	Timing
1	Nontreated	-				-	-		
2	Nontreated + IRR	-				0.25"	-		
3	UF 01	*classified*				-	2	6	AC
4	UF 01 + IRR	*classified*				0.25"	2	6	AC
5	UF 01	*classified*				-	2	6	AC
6	UF 01 + IRR	*classified*				0.25"	2	6	AC
7	Sencor 75%	metribuzin	5	Bayer	4.0	-	2	2	AB
8	Sencor 75% + IRR	metribuzin	5	Bayer	4.0	0.25"	2	2	AB
9	Pylex	topramezone	27	BASF	0.25	-	2	2	AB
10	Pylex + IRR	topramezone	27	BASF	0.25	0.25"	2	2	AB
11	Pylex	topramezone	27	BASF	0.5	-	1	-	A
12	Pylex + IRR	topramezone	27	BASF	0.5	0.25"	1	-	A
13	Sencor 75%	metribuzin	5	Bayer	4.0	-	2	2	AB
	+ Pylex	topramezone	27	BASF	0.15				AB
14	Sencor 75%	metribuzin	5	Bayer	4.0	0.25"	2	2	AB
	+ Pylex + IRR	topramezone	27	BASF	0.15				AB
15	Sencor 75%	metribuzin	5	Bayer	4.0	-	2	2	AB
	+ Pylex	topramezone	27	BASF	0.25				AB
16	Sencor 75%	metribuzin	5	Bayer	4.0	0.25"	2	2	AB
	+ Pylex + IRR	topramezone	27	BASF	0.25				AB
17	Target 6.6	MSMA	0	Luxembourg-Pamol	40.0	-	2	2	AB
18	Revolver	foramsulfuron	2	Bayer	17.4	-	2	2	AB
19	Revolver	foramsulfuron	2	Bayer	26.2	-	2	2	AB
20	Sencor 75%	metribuzin	5	Bayer	6.0	-	2	2	AB
21	Sencor 75%	metribuzin	5	Bayer	8.0	-	2	2	AB
22	Aquesta 4F	sulfentrazone	14	Atticus	8.0	-	2	2	A
					4.0	-	2	2	B
23	Tribute Total	thiencarbazone	2	Bayer	3.2	-	2	2	AB
		+ foramsulfuron	2						
		+ halosulfuron	2						
24	Tenacity	mesotrione	27	Syngenta	5.0	-	2	2	AB
25	Princep Liquid	simazine	5	Syngenta	15.0	-	2	2	AB
26	Manuscript	pinoxaden	1	Syngenta	42.0	-	2	2	AB
27	Target 6.6	MSMA	0	Luxembourg-Pamol	40.0	-	2	2	AB
	+ Sencor 75%	metribuzin	5	Bayer	6.0	-	2	2	AB
28	Revolver	foramsulfuron	2	Bayer	17.4	-	2	2	AB
	+ Aquesta 4F	sulfentrazone	14	Atticus	8.0				A
					4.0				B
29	Revolver	foramsulfuron	2	Bayer	26.2	-	2	2	AB
	+ Aquesta 4F	sulfentrazone	14	Atticus	8.0				A
					4.0				B

No.	Treatment	Active ingredient	HRAC & WSSA Code	Company	Rate (oz/A)	Post-app. irrigation	No. of apps.	Freq. (wks)	Timing
30	Revolver	foramsulfuron	2	Bayer	17.4	-	2	2	AB
	+ Sencor 75%	metribuzin	5	Bayer	6.0				
31	Revolver	foramsulfuron	2	Bayer	26.2	-	2	2	AB
	+ Sencor 75%	metribuzin	5	Bayer	6.0				
32	Sencor 75%	metribuzin	5	Bayer	6.0	-	2	2	AB
	+ Aquesta 4F	sulfentrazone	14	Atticus	8.0				A
					4.0				B
33	Sencor 75%	metribuzin	5	Bayer	8.0	-	2	2	AB
	+ Aquesta 4F	sulfentrazone	14	Atticus	8.0				A
					4.0				B
34	Tenacity	mesotrione	27	Syngenta	5.0	-	2	2	AB
	+ Princep Liquid	simazine	5	Syngenta	15.0				
35	Tenacity	mesotrione	27	Syngenta	5.0	-	2	2	AB
	+ Princep Liquid	simazine	5	Syngenta	15.0				
	+ Manuscript	pinoxaden	1	Syngenta	42.0				

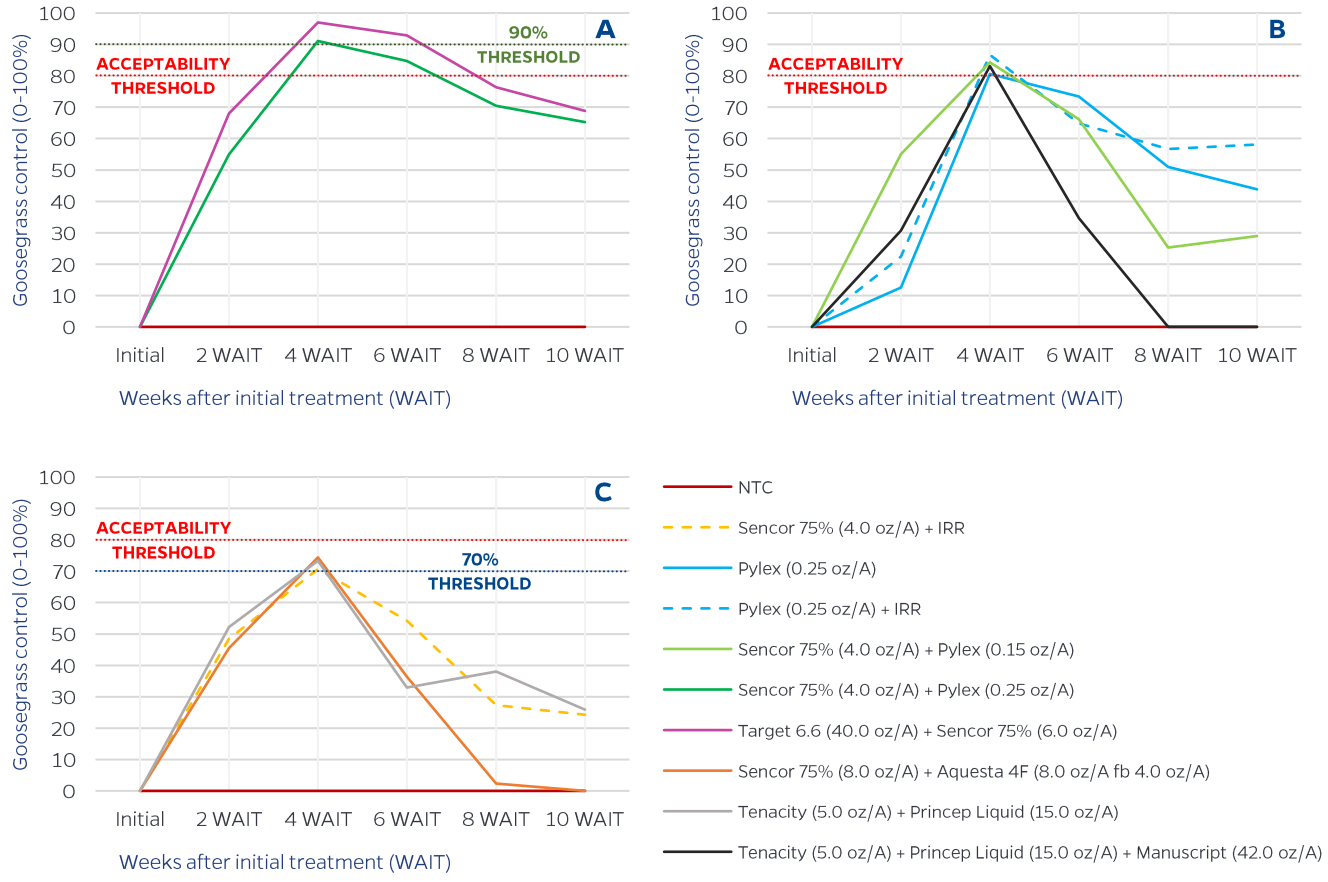

Figure 1. Effects of chosen [best performing (A), peaking at above 80% control at 4 weeks after initial treatment (WAIT; B), and peaking between 70% and 80% control at 4 WAIT (C)] herbicide treatments on the postemergence control of goosegrass (0-100%, y-axis) in bermudagrass turf. 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

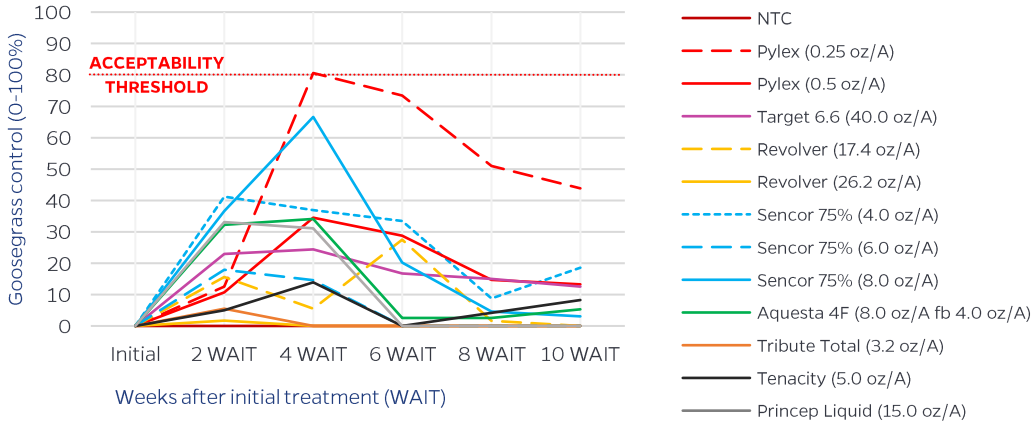

Figure 2. Effect of chosen single mode of action (MOA) based herbicide treatments on the control of goosegrass (0-100%, y-axis) in bermudagrass turf. 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

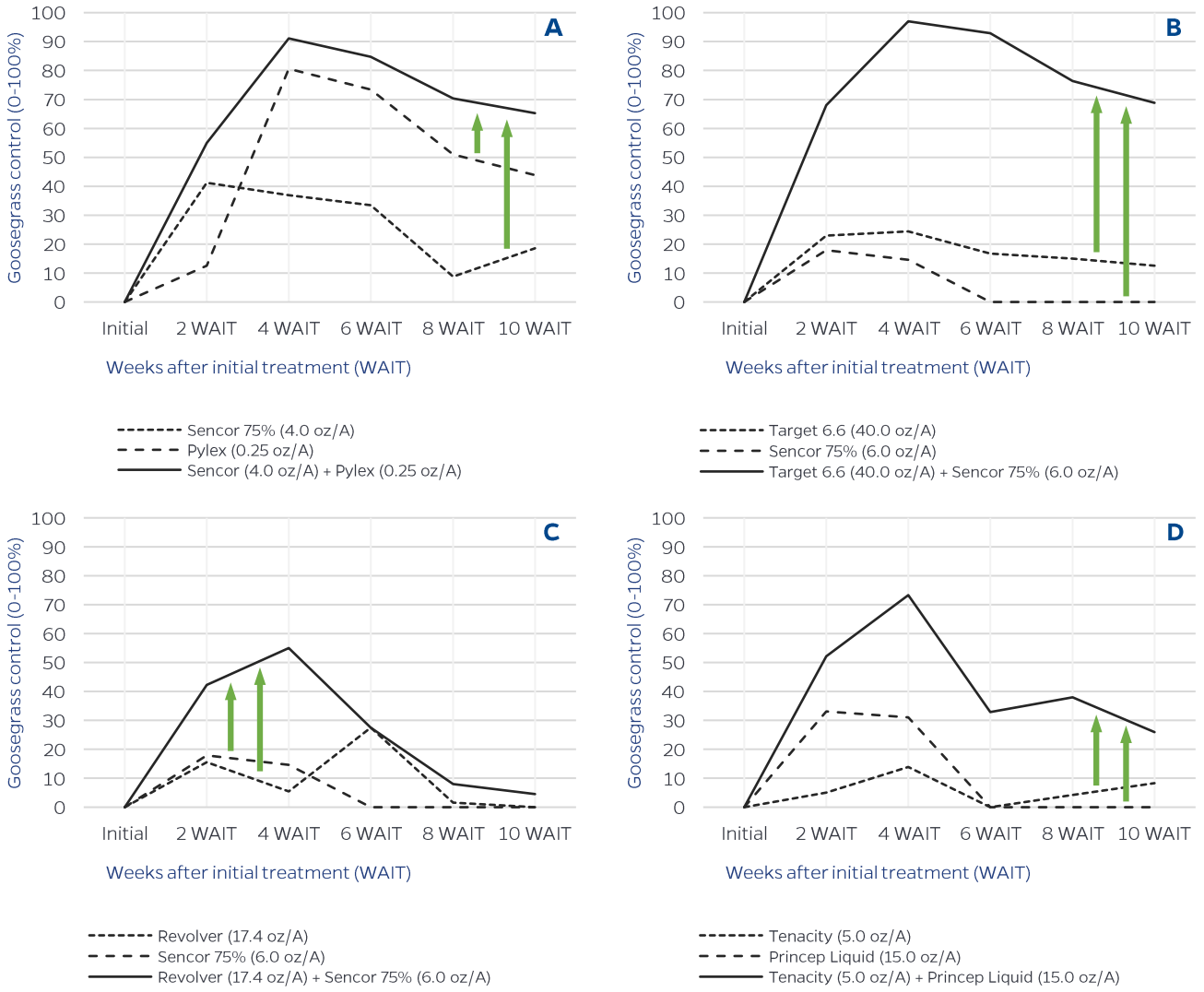

Figure 3. Comparison of effects of chosen single mode of action (MOA; dashed lines) treatments with their dual MOA tank-mixes (solid lines) on the postemergence control of goosegrass (0-100%, y-axis) in bermudagrass turf. 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

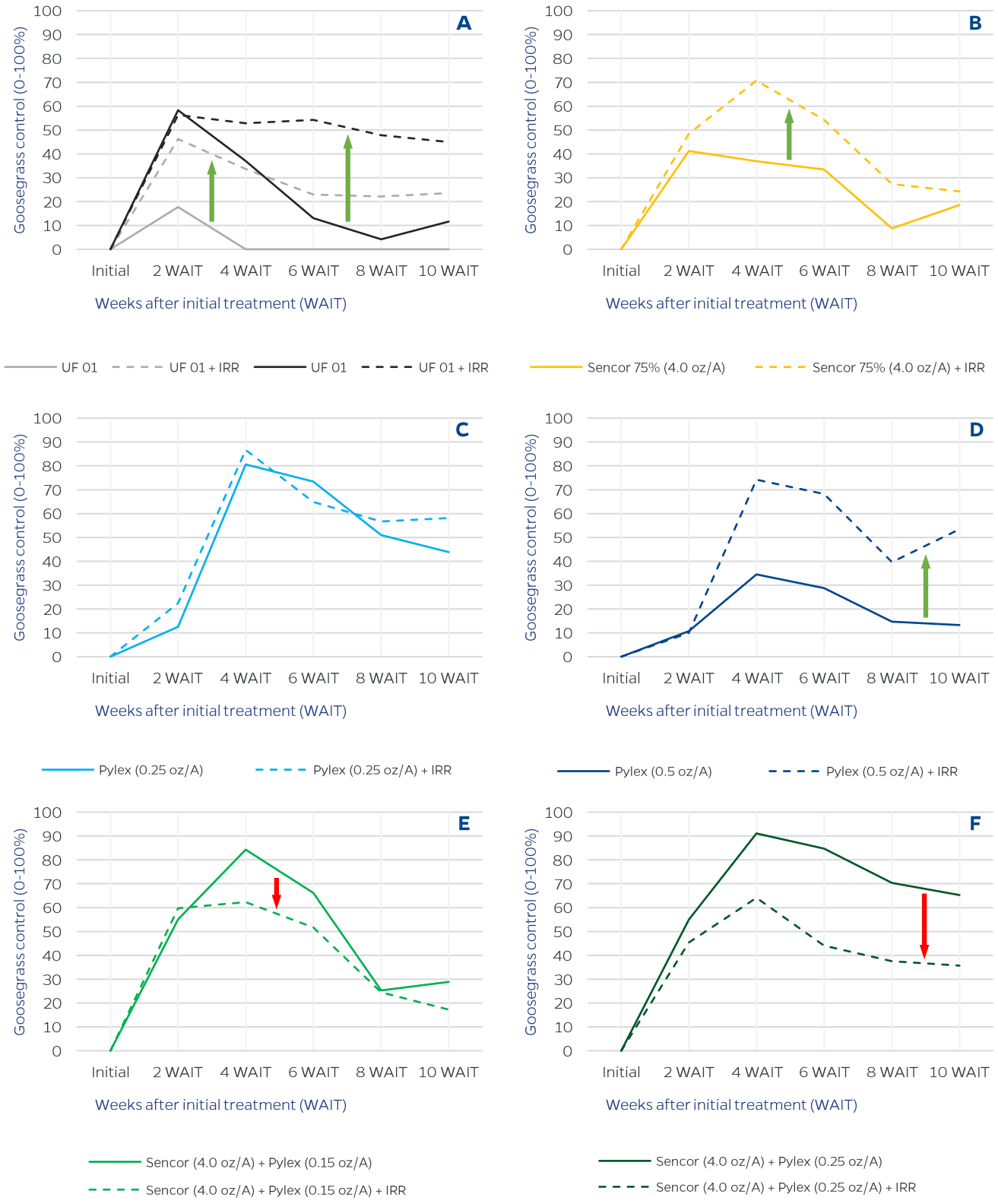

Figure 4. Effect of immediate post-herbicide application irrigation (IRR; dashed lines) on the performance of standalone UF 01 (A), Sencor 75% (B), and Pylex (C, D), and tank-mixes of Sencor 75% + Pylex (E, F) in postemergence control of goosegrass (0-100%, y-axis) in bermudagrass turf. 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

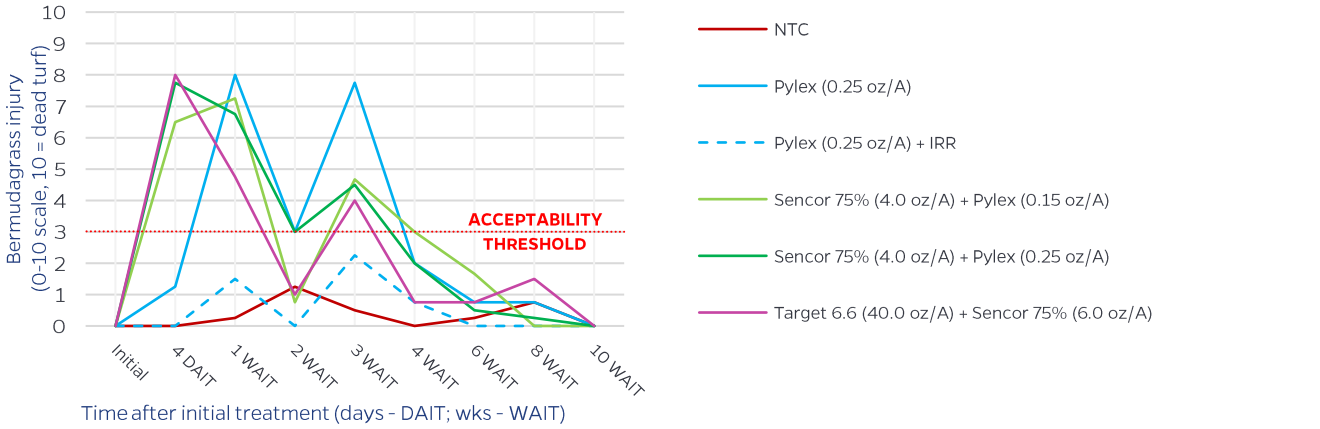

Figure 5. Effect of chosen (top 5 most efficacious) herbicide treatments on bermudagrass injury (0-10 scale, y-axis) in bermudagrass turf. 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

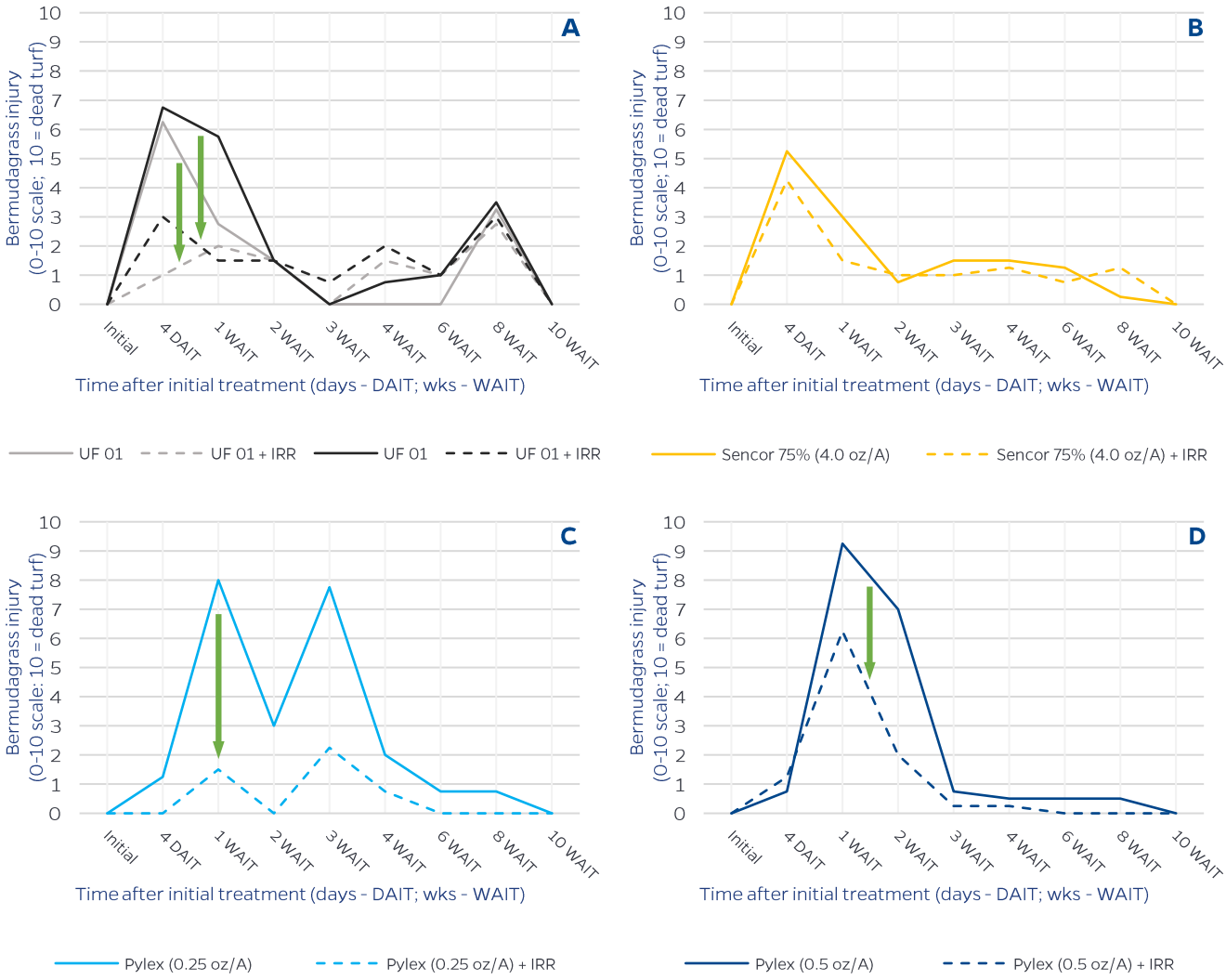

Figure 6. Effect of immediate post-herbicide application irrigation (IRR; dashed lines) on bermudagrass injury (0-10 scale, y-axis) with standalone UF 01 (A), Sencor 75% (B), and Pylex (C, D). 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

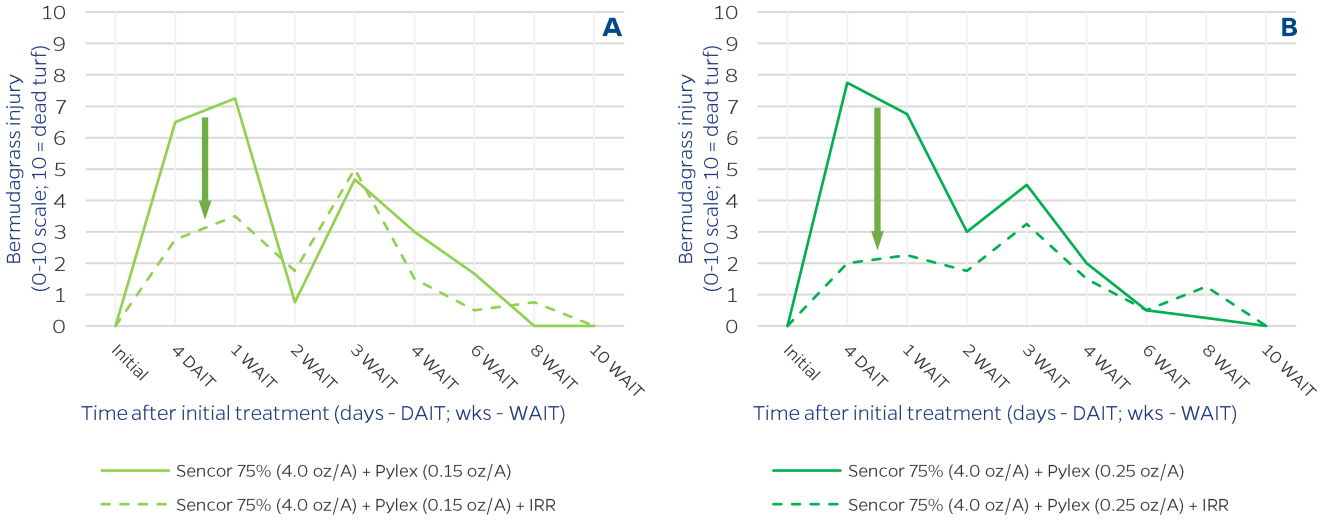

Figure 7. Effect of immediate post-herbicide application irrigation (IRR; dashed lines) on bermudagrass injury (0-10 scale, y-axis) with tank-mixes of Sencor 75% a 4.0 oz/A + Pylex at 0.15 oz/A (A) and 0.25 oz/A (B). 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL.

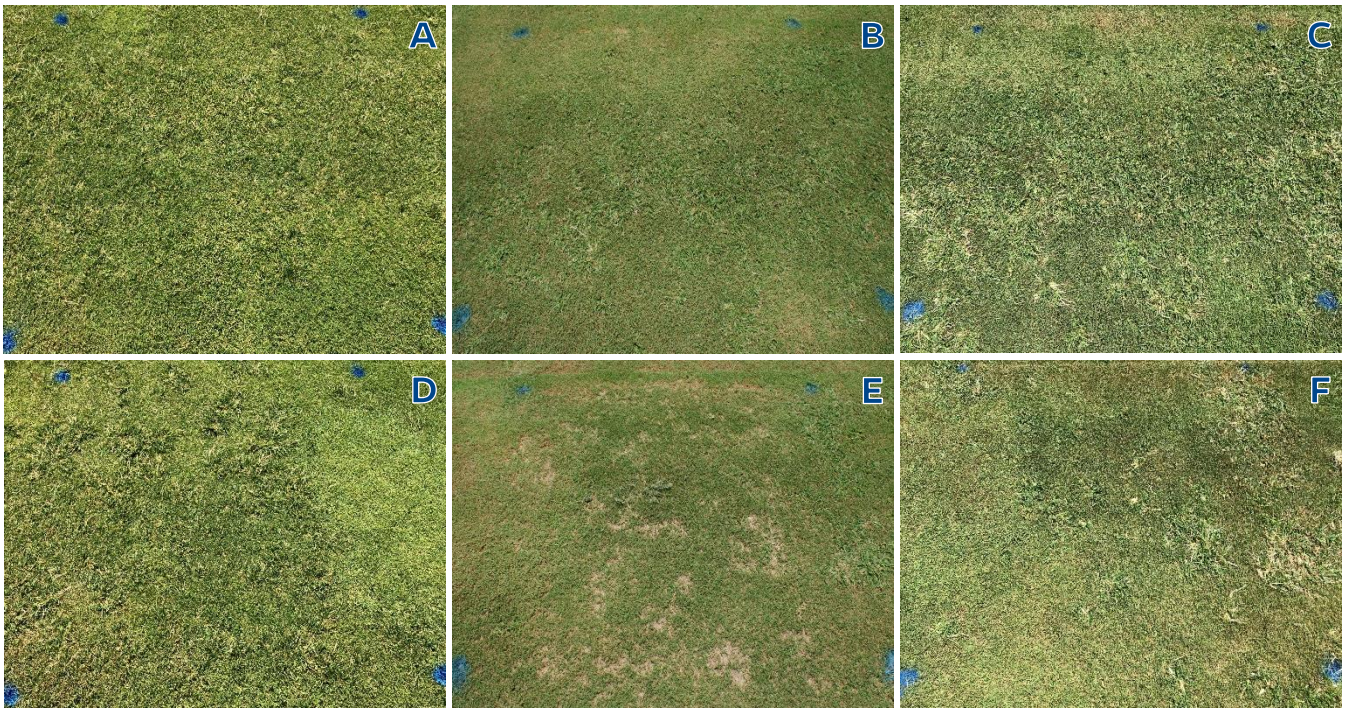

Figure 8. Goosegrass cover in nontreated control (A, B, C) and Sencor 75% at 4.0 oz/A + Pylex at 0.25 oz/A (D, E, F) treated plots at study initiation on June 10 (A,D), at 4 weeks after initial treatment (WAIT) on July 9 (B, E), and at 10 WAIT on August 20 (C, F). 2021. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL. Photos by Pawel Petelewicz.

Table 2. Effects of herbicide and immediate post-application irrigation (watering-in) treatments on goosegrass control (0-100%) evaluated in bermudagrass 'Tifway 419' maintained as a golf course fairway or athletic field. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL. 2021.

No.	Treatment	Goosegrass control (0-100%)				
		2 WAIT *	4 WAIT	6 WAIT	8 WAIT	10 WAIT
1	Nontreated	0.0 j ****	0.0 j	0.0 h	0.0 f	0.0 h
2	Nontreated + IRR	7.8 f-j	7.8 j	0.0 h	0.0 f	0.0 h
3	UF 01 **	17.7 c-j	0.0 j	0.0 h	0.0 f	0.0 h
4	UF 01 + IRR	46.2 a-f	33.6 f-j	22.9 f-h	22.1 d-f	23.6 d-h
5	UF 01	58.3 ab	37.0 d-j	13.1 gh	4.2 f	11.6 f-h
6	UF 01 + IRR	56.3 a-c	52.8 c-h	54.2 a-f	47.8 a-d	45.0 a-e
7	Sencor 75%	41.2 a-h	36.9 d-j	33.4 d-h	8.8 ef	18.6 e-h
8	Sencor 75% + IRR	48.4 a-e	70.7 a-f	54.2 a-f	27.3 c-f	24.3 d-h
9	Pylex (0.25 oz/A)	12.5 e-j	80.6 a-c	73.4 a-c	51.0 a-d	43.8 a-f
10	Pylex + IRR	22.4 b-j	86.7 a-c	64.8 a-e	56.7 a-c	58.1 a-c
11	Pylex	10.7 e-j	34.5 f-j	28.8 e-h	14.7 ef	13.3 e-h
12	Pylex + IRR	10.0 e-j	74.2 a-d	68.2 a-d	39.7 b-e	53.4 a-d
13	Sencor 75% + Pylex	55.1 a-c	84.3 a-c	66.2 a-e	25.3 c-f	28.9 c-h
14	Sencor 75% + Pylex + IRR	59.8 ab	62.3 a-g	51.7 b-g	24.5 d-f	17.2 e-h
15	Sencor 75% + Pylex	55.0 a-c	91.1 ab	84.7 ab	70.4 ab	65.3 ab
16	Sencor 75% + Pylex + IRR	45.4 a-g	64.1 a-g	44.0 c-g	37.5 c-e	35.7 b-g
17	Target 6.6	22.9 b-j	24.4 h-j	16.7 f-h	15.0 ef	12.5 e-h
18	Revolver	15.6 d-j	5.5 j	27.5 e-h	1.6 f	0.0 h
19	Revolver	1.7 ij	0.0 j	0.0 h	0.0 f	0.0 h
20	Sencor 75%	17.9 c-j	14.6 ij	0.0 h	0.0 f	0.0 h
21	Sencor 75%	36.6 a-j	66.6 a-g	20.2 f-h	4.6 f	3.1 gh
22	Aquesta 4F	32.2 a-j	34.1 f-j	2.5 h	2.5 f	5.3 gh
23	Tribute Total	5.5 h-j	0.0 j	0.0 h	0.0 f	0.0 h
24	Tenacity	5.0 h-j	13.9 ij	0.0 h	4.2 f	8.3 gh
25	Princep Liquid	33.1 a-j	31.1 g-j	0.0 h	0.0 f	0.0 h
26	Manuscript	6.3 g-j	0.0 j	0.0 h	0.0 f	0.0 h
27	Target 6.6 + Sencor 75%	68.0 a	97.0 a	92.9 a	76.4 a	68.8 a
28	Revolver + Aquesta 4F	29.9 a-j	22.5 h-j	18.8 f-h	18.8 d-f	18.8 e-h
29	Revolver + Aquesta 4F	21.7 b-j	10.4 j	0.0 h	0.0 f	0.0 h
30	Revolver + Sencor 75%	42.3 a-h	55.0 b-h	27.5 e-h	8.0 ef	4.5 gh
31	Revolver + Sencor 75%	22.0 b-j	36.4 e-j	27.4 e-h	1.6 f	0.0 h
32	Sencor 75% + Aquesta 4F	39.4 a-i	50.6 c-i	22.3 f-h	25.0 c-f	17.0 e-h
33	Sencor 75% + Aquesta 4F	45.5 a-g	74.4 a-d	36.4 c-h	2.3 f	0.0 h
34	Tenacity + Princep Liquid	52.2 a-d	73.3 a-e	32.9 d-h	38.0 c-e	25.9 c-h
35	Tenacity + Princep Liquid + Manuscript	30.7 a-j	83.1 a-c	34.7 c-h	0.0 f	0.0 h

* WAIT – weeks after initial treatment
** For herbicide rates, refer to Table 1
*** Means followed by the same letter or by no letter in a column are not significantly different (P=0.05).

Table 3. Effects of herbicide and immediate post-application irrigation (watering-in) treatments on desired turfgrass injury (0-10 scale, 0 = no injury, 3 = acceptable threshold, 10 = dead turf) evaluated on bermudagrass 'Tifway 419' maintained as a golf course fairway or athletic field. UF/IFAS Fort Lauderdale Research and Education Center (FLREC), Davie, FL. 2021.

No.	Treatment	Bermudagrass injury (0-10 scale)							
		4 DAIT *	1 WAIT **	2 WAIT	3 WAIT	4 WAIT	6 WAIT	8 WAIT	10 WAIT
1	Nontreated	0.0 j ****	0.3 mn	1.3 e-i	0.5 g	0.0 f	0.3	0.8 b-d	0.0
2	Nontreated + IRR	0.0 j	0.3 mn	0.8 g-i	0.8 g	0.3 ef	0.0	1.0 b-d	0.0
3	UF 01 **	6.3 a-c	2.8 h-k	1.5 d-i	0.0 g	0.0 f	0.0	3.3 a	0.0
4	UF 01 + IRR	1.0 h-j	2.0 j-n	1.5 d-i	0.0 g	1.5 c-f	1.0	2.8 a	0.0
5	UF 01	6.8 a-c	5.8 d-f	1.5 d-i	0.0 g	0.8 d-f	1.0	3.5 a	0.0
6	UF 01 + IRR	3.0 e-h	1.5 j-n	1.5 d-i	0.8 g	2.0 c-e	1.0	3.0 a	0.0
7	Sencor 75%	5.3 b-f	3.0 g-j	0.8 g-i	1.5 fg	1.5 c-f	1.3	0.3 cd	0.0
8	Sencor 75% + IRR	4.3 c-g	1.5 j-n	1.0 f-i	1.0 fg	1.3 c-f	0.8	1.3 bc	0.0
9	Pylex	1.3 h-j	8.0 a-c	3.0 cd	7.8 ab	2.0 c-e	0.8	0.8 b-d	0.0
10	Pylex + IRR	0.0 j	1.5 j-n	0.0 i	2.3 e-g	0.8 d-f	0.0	0.0 d	0.0
11	Pylex	0.8 h-j	9.3 a	7.0 a	0.8 g	0.5 d-f	0.5	0.5 b-d	0.0
12	Pylex + IRR	1.3 h-j	6.3 c-f	2.0 d-g	0.3 g	0.3 ef	0.0	0.0 d	0.0
13	Sencor 75% + Pylex	6.5 a-c	7.3 a-d	0.8 g-i	4.7 c-e	3.0 bc	1.7	0.0 cd	0.0
14	Sencor 75% + Pylex + IRR	2.8 f-i	3.5 g-j	1.8 d-h	5.0 cd	1.5 c-f	0.5	0.8 b-d	0.0
15	Sencor 75% + Pylex	7.8 ab	6.8 b-e	3.0 cd	4.5 c-e	2.0 c-e	0.5	0.3 cd	0.0
16	Sencor 75% + Pylex + IRR	2.0 g-j	2.3 j-m	1.8 d-h	3.3 d-f	1.5 c-f	0.5	1.3 bc	0.0
17	Target 6.6	3.3 d-h	0.8 k-n	0.3 hi	0.8 g	0.3 ef	0.5	0.0 d	0.0
18	Revolver	0.3 ij	0.0 n	0.0 i	0.0 g	0.3 ef	0.3	0.0 d	0.0
19	Revolver	0.0 j	0.0 n	0.0 i	0.5 g	0.0 f	0.3	0.0 d	0.0
20	Sencor 75%	5.8 a-d	4.5 f-i	0.5 g-i	2.3 e-g	0.0 f	0.3	0.3 cd	0.0
21	Sencor 75%	6.3 a-c	6.5 b-f	2.5 d-f	5.0 cd	1.5 c-f	1.3	0.8 b-d	0.0
22	Aquesta 4F	0.0 j	0.3 mn	0.5 g-i	0.3 g	0.8 d-f	0.8	0.0 d	0.0
23	Tribute Total	1.0 h-j	2.5 i-l	0.8 g-i	0.8 g	0.0 f	2.3	0.3 cd	0.0
24	Tenacity	0.8 h-j	6.8 b-e	2.8 c-e	6.3 bc	0.5 d-f	0.3	0.0 d	0.0
25	Princep Liquid	0.3 ij	0.3 mn	0.8 g-i	1.0 fg	0.5 d-f	0.8	0.3 cd	0.0
26	Manuscript	1.0 h-j	1.5 j-n	0.0 i	1.5 fg	0.0 f	0.3	0.0 d	0.0
27	Target 6.6 + Sencor 75%	8.0 a	4.8 e-h	1.0 f-i	4.0 c-e	0.8 d-f	0.8	1.5 b	0.0
28	Revolver + Aquesta 4F	1.5 h-j	0.3 mn	0.0 i	0.0 g	0.5 d-f	0.3	0.0 d	0.0
29	Revolver + Aquesta 4F	1.5 h-j	0.5 l-n	0.0 i	0.3 g	0.0 f	0.3	0.0 d	0.0
30	Revolver + Sencor 75%	7.5 ab	6.0 c-f	2.0 d-g	5.3 cd	1.0 c-f	1.0	0.0 d	0.0
31	Revolver + Sencor 75%	7.0 ab	5.0 e-g	0.5 g-i	4.0 c-e	1.3 c-f	0.8	0.8 b-d	0.0
32	Sencor 75% + Aquesta 4F	7.3 ab	5.8 def	1.3 e-i	5.0 cd	1.0 c-f	1.0	0.5 b-d	0.0
33	Sencor 75% + Aquesta 4F	6.3 a-c	5.0 e-g	2.0 d-g	4.5 c-e	2.3 cd	1.3	0.3 cd	0.0
34	Tenacity + Princep Liquid	5.5 a-e	8.5 ab	4.3 bc	7.8 ab	4.3 ab	1.0	0.5 b-d	0.0
35	Tenacity + Princep Liquid + Manuscript	5.3 a-f	7.8 a-d	5.0 b	9.0 a	6.0 a	2.0	0.3 b-d	0.0

* DAIT – weeks after initial treatment
** WAIT – weeks after initial treatment
*** For herbicide rates, refer to Table 1
**** Means followed by the same letter or by no letter in a column are not significantly different (P=0.05).

Disclaimer: Be advised that the results of the presented study **DO NOT** constitute an official UF/IFAS recommendation.

For research purposes, our studies may include experimental compounds and/or commercially available products not labeled for use under researched conditions (e.g., for particular setting, turfgrass species, target weed species, etc.), and/or purposedly applied contradictory or not in full accordance with the product's label (e.g., excessive, or insufficient rates, wrong timings, applications in sub-optimal conditions, etc.).

For official UF/IFAS recommendations refer to EDIS publications available online via ask.ifas portal at https://edis.ifas.ufl.edu/. These publications and other helpful resources may be also accessed either via Turfgrass Science Program website at https://turf.ifas.ufl.edu/ or via Turfgrass Weed Science laboratory website at https://agronomy.ifas.ufl.edu/turfgrass-weed-science/.

Before deciding upon employing pesticides as well as when using such chemistries, always refer to the product label for instructions on its proper and legal handling!