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Postemergence Control of English Daisy in Cool-Season Turf 2019 Report

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Postemergence Control of English Daisy in Cool-Season Turf 2019 Report

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The Bottom Line: Seventeen treatments containing commercial and experimental herbicides alone or in combination were tested against an untreated control for postemergence control of English daisy (*Bellis perennis*) in a mixed stand of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) maintained as golf course rough. Study was conducted at the Olympic Club in San Francisco. Treatments were applied twice every 8 wks or 3 times every 4 wks starting May 2019. Both UCR 002 treatments and Sapphire at 1.5 pints/A, all applied 2 times on 8-wk intervals, resulted in rapid and the most effective target weed control. However, at the same time those treatments resulted in significant turf injury, which persisted for 4-6 wks following each application. Three applications of Pylex (1.0 oz/A) on 4-wk intervals provided statistically similar English daisy control without turf injury when applied alone or tank-mixed with Turflon Ester at 32 oz/A. Turflon Ester, either at 16 oz/A or 32 oz/A, improved performance of both Pylex and Tenacity herbicides, regardless of the total number of applications, while Drive XLR8 seemed to diminish efficacy of Pylex.

Acknowledgments

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Introduction

English lawn daisy or English daisy (*Bellis perennis*) was originally an ornamental species brought to California from Europe as a garden plant; however, it ultimately invaded turf and currently is one of the most difficult to eradicate perennial broadleaf weeds, especially in Northern California. English daisy spreads mostly by rhizomes and seed, and is adapted to a wide range of environmental conditions and cultural practices including cool, moist, shady environments on heavier, fertile soils. Plants are low-growing and can tolerate relatively close mowing (ca. 1 in.). English daisy has a prostrate or spreading growth habit and can stay hidden in the turf canopy until flowering occurs. Flowers are small and typical for *Asteraceae*, white or pinkish with yellow centers. A single plant can produce numerous flowers, which disrupts turf uniformity.

English daisy is tolerant to many common broadleaf herbicides. Recent research identified penoxsulam (Sapphire), an acetolactate synthase (ALS) inhibitor, to provide effective control of this species. However, this herbicide can be injurious to perennial ryegrass, which is often the desired turf species invaded by English daisy.

Cover photo taken by P. Petelewicz on May 14, 2019. Riverside, CA.

Objectives

This study was conducted to evaluate and compare the efficacy of various rates and formulations of herbicides to control English daisy (*Bellis perennis*) postemergence in perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) mixed turfgrass stand maintained as golf course rough in Northern California.

Materials and Methods

The study was conducted in the rough at the Olympic Club in San Francisco. Turf was a mix of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) mowed weekly at 1.5 inches and received 2 lbs N/1000 ft^2/year in the 2019 season. Herbicide treatments were applied on May 30, June 25 and July 24, 2019. Non-ionic surfactant (NIS) or methylated seed oil (MSO) were added to the tank mix as prescribed by the herbicide treatment (Table 1). Treatments were applied using a CO_2-powered backpack sprayer equipped with TeeJet 8002VS nozzles calibrated to deliver 1 gallon/1000 ft^2. Experimental design was a complete randomized block with 4 replications. Plot size was 4 ft × 6 ft with 1-ft alleys.

Starting from May 30, 2019 plots were evaluated weekly for target weed control expressed as the percentage of ratio between initial cover and cover at the time of evaluation (0-100%), target weed injury (0-10; 10=highest) and flowering occurrence (0-5; 5=highest), as well as for visual quality (1-9; 9=best) and turfgrass injury caused by treatments (phytotoxicity; 0-10; 10=highest).

Data collected throughout the study were analyzed using analysis of variance for each evaluated trait separately and the means were compared using the Fisher's protected least significant difference (LSD) test at the 0.05 probability level ($P \leq 0.05$).

Results

The first effect observed in this study was the impact of herbicides on English daisy flowering. All treatments, except for Tenacity alone (regardless of application frequency) significantly decreased flowering following initial application. However, the strongest flowering inhibition, which persisted until the end of the study, occurred with UCR 002 (treatment 6 only). At the same date, flowering inhibition was not statistically significantly different among treatment 6, UCR 001 (treatment 4 only), UCR 002 (treatment 5), Sapphire, and all tank-mixes of Turflon Ester with either Tenacity or Pylex (Fig. 3). Eventually, by the final data collection event, both UCR 002 treatments and Sapphire provided complete flower suppression. Those treatments were not statistically different from UCR 001 (treatment 4 only), UCR 003 and UCR 004 tank-mix as well as from Tenacity or Pylex applied 3 times on a 4-wk interval, either alone or when tank-mixed with Turflon Ester (Table 2).

Injury to English daisy was also observed immediately following initial herbicide application, demonstrated by initial leaf yellowing and bronzing, which led to desiccation and ultimately necrosis. Significant injury symptoms at 2 weeks after initial treatment (WAIT) were, apart from Tenacity alone and Pylex alone (treatment 13 only), visible throughout the entire study (data not shown), although they were most rapidly appearing in plots treated with UCR 002 (both treatments) and Sapphire, leading to the peak of injury at 4 WAIT (Table 2). All observed target weed injury gradually faded over time due to either reduction in English daisy populations and/or lack of persisting herbicidal activity (data not shown).

Both UCR 002 treatments and Sapphire resulted in the most rapid and effective English daisy control, leading to almost full eradication starting from 4 WAIT (Fig. 2). The second application ensured the removal

of remaining plants, providing 100% target weed control by the final rating event (Table 2, Figs. 2-4). No significant differences were shown on this date between the aforementioned treatments and Pylex applied 3 times on a 4-wk interval, either alone or as a tank-mix constituent with Turflon Ester (Table 2, Fig. 5). However, treatments containing Pylex did not exceed 90% target weed control (Table 2) and did not provide as rapid control in comparison to UCR 002 or Sapphire (Fig. 2). Apart from already discussed, none of the treatments applied 2 times at 8-wk interval provided sustained weed control, resulting in close to complete English daisy recovery by the time of the second application. In this case, the second application did not provide satisfactory control either (Fig. 2). Interestingly, the addition of Turflon Ester as a tank-mix component with either Tenacity or Pylex, resulted in improved performance when compared to either product applied alone. On the other hand, the addition of Drive XLR8 to Pylex treatments tended to reduce weed control, regardless of the number of total applications performed (Table 2, Fig. 2).

UCR 002 (treatment 6) and Sapphire caused significant turf injury after each application, which persisted for 4-6 wks. Injury was demonstrated by foliage discoloration (straw-coloring and bronzing) and some necrosis (Fig. 7). Furthermore, this injury crossed the acceptable threshold at 2 WAIT. UCR 002 (treatment 5) and the tank-mix of UCR 003 and UCR 004 also resulted in some injury, although only significant after initial application. Lastly, some significant injury was also observed in plots treated with Pylex alone (treatment 14) following its third application. However, injury was limited to bleaching (Fig. 7) on warm-season turfgrass species mixed in the sward. Additionally, application of UCR 002 and Sapphire led to the occurrence of voids resulting from rapid target weed removal and lack of turfgrass recovery (Fig. 6).

Ultimately, by the end of the study, both UCR 002 treatments, Sapphire and tank-mix of Pylex with Turflon Ester (applied 3 times on 4-wk interval) resulted in the best weed control and highest turfgrass visual quality (Table 2).

Tables and Figures

Table 1. Herbicide treatments tested in the postemergence English daisy (*Bellis perennis*) control study in San Francisco, CA. 2019.

No.	Treatment	Active ingredient	Company	Rate		No. of apps	Freq. (wks)	Timing
1	Untreated Control	-	-	-	-	-	-	-
2	UCR 001	*classified*	-	-	-	2	8	AC
3	UCR 001	*classified*	-	-	-	2	8	AC
4	UCR 001	*classified*	-	-	-	2	8	AC
5	UCR 002	*classified*	-	-	-	2	8	AC
6	UCR 002	*classified*	-	-	-	2	8	AC
7	UCR 003	*classified*	-	-	-	2	8	AC
	UCR 004	*classified*	-	-	-	2	8	AC
8	Sapphire	penoxsulam	Corteva	1.50	pints/A	2	8	AC
	Activator 90	*non-ionic surfactant*	Loveland	0.25	% v/v	2	8	AC
9	Tenacity	mesotrione	Syngenta	5.00	oz/A	2	8	AC
	Activator 90	*non-ionic surfactant*	Loveland	0.25	% v/v			
10	Tenacity	mesotrione	Syngenta	5.00	oz/A	3	4	ABC
	Activator 90	*non-ionic surfactant*	Loveland	0.25	% v/v			
11	Tenacity	mesotrione	Syngenta	5.00	oz/A	2	8	AC
	Turflon Ester	triclopyr	Corteva	16.00	oz/A			
12	Tenacity	mesotrione	Syngenta	5.00	oz/A	3	4	ABC
	Turflon Ester	triclopyr	Corteva	16.00	oz/A			
13	Pylex	topramezone	BASF	1.00	oz/A	2	8	AC
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			
14	Pylex	topramezone	BASF	1.00	oz/A	3	4	ABC
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			
15	Pylex	topramezone	BASF	1.00	oz/A	2	8	AC
	Turflon Ester	triclopyr	Corteva	32.00	oz/A			
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			
16	Pylex	topramezone	BASF	1.00	oz/A	3	4	ABC
	Turflon Ester	triclopyr	Corteva	32.00	oz/A			
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			
17	Pylex	topramezone	BASF	1.00	oz/A	2	8	AC
	Drive XLR8	quinclorac	BASF	32.00	oz/A			
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			
18	Pylex	topramezone	BASF	1.00	oz/A	3	4	ABC
	Drive XLR8	quinclorac	BASF	32.00	oz/A			
	MSO Concentrate	*methylated seed oil*	Loveland	0.50	% v/v			

Application codes (timing):

A – 05/30/2019
B – 06/25/2019
C – 07/24/2019

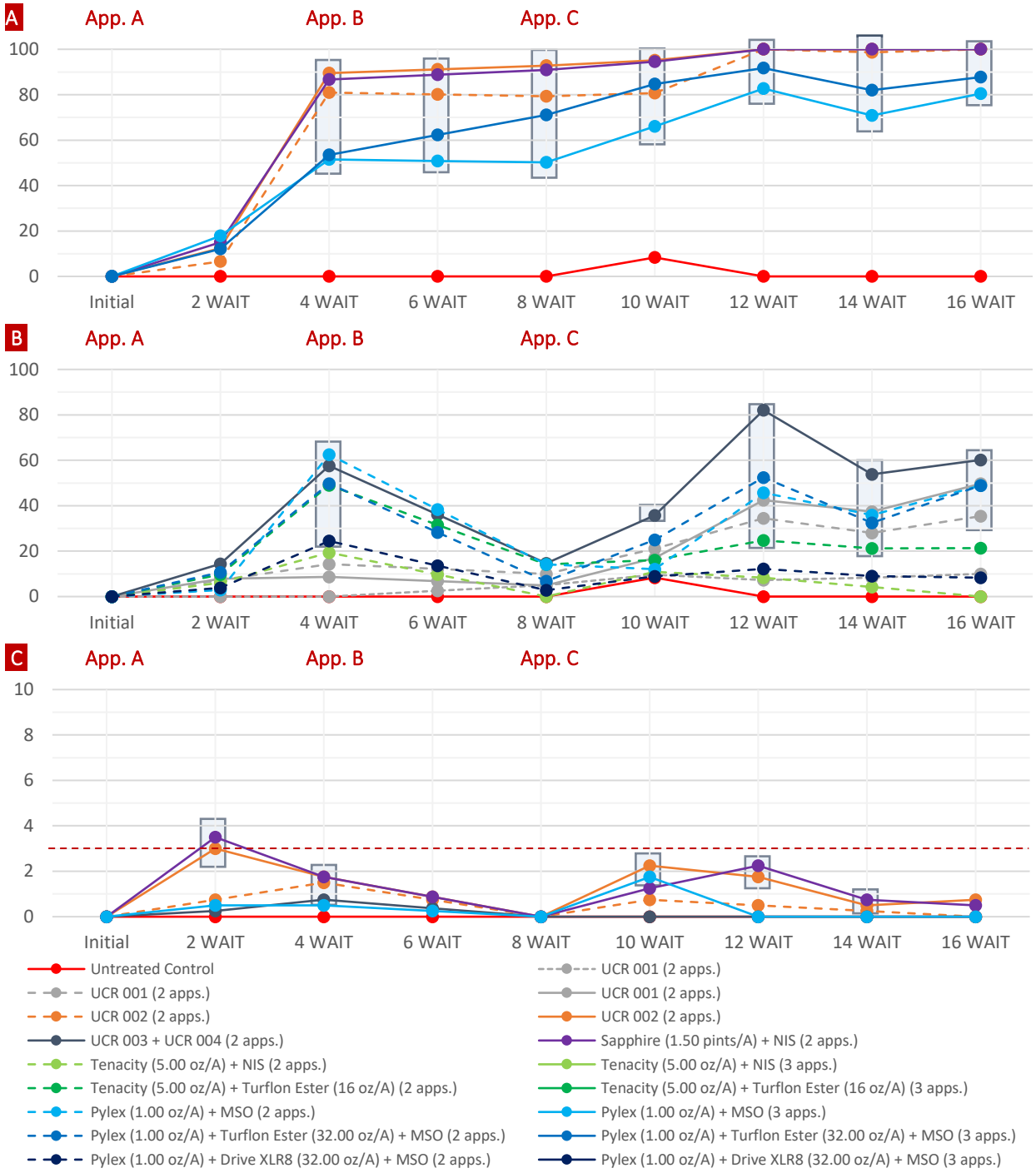
Table 2. Effect of postemergence herbicide treatments on target weed (English daisy (*Bellis perennis*)) flowering rate (0-5, 5=highest), target weed injury caused by treatments (0-10, 10=highest), target weed control (0-100%) and on plots visual quality (1-9; 9=best) evaluated on mixed stand of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) in San Francisco, CA. 2019.

No.	Treatment	English Daisy Flowering Rate		English Daisy Injury	English Daisy Control	Plots Visual Quality
		2 WAIT*	16 WAIT*	4 WAIT*	16 WAIT*	16 WAIT*
1	Untreated Control	5.0 A**	4.8 A**	0.0 E**	0 G**	3.3 F**
2	UCR 001 (2 apps.)	3.0 CD	2.0 B-D	1.0 C-E	10 FG	3.5 EF
3	UCR 001. (2 apps.)	2.8 DE	2.0 B-D	1.8 CD	35 EF	4.3 D-F
4	UCR 001 (2 apps.)	1.3 FG	1.3 C-G	2.0 CD	50 DE	4.8 D-F
5	UCR 002 (2 apps.)	1.5 FG	0.0 G	8.5 A	100 A	7.3 A
6	UCR 002 (2 apps.)	0.5 G	0.0 G	9.3 A	100 A	6.5 A-C
7	UCR 003 + UCR 004 (2 apps.)	1.8 EF	1.0 D-G	6.3 B	60 C-E	5.0 C-E
8	Sapphire (2 apps.)	0.8 FG	0.0 G	8.8 A	100 A	6.8 AB
9	Tenacity (2 apps.)	4.0 A-C	2.8 B	1.0 C-E	0 G	3.5 EF
10	Tenacity (3 apps.)	4.8 A	1.3 C-G	0.0 E	15 FG	4.5 D-F
11	Tenacity + Turflon Ester (2 apps.)	1.0 FG	1.5 B-F	2.5 C	21 FG	3.8 EF
12	Tenacity + Turflon Ester (3 apps.)	0.8 FG	0.8 D-G	1.0 C-E	61 B-E	4.8 D-F
13	Pylex (2 apps.)	4.3 AB	0.3 FG	0.5 DE	49 DE	5.0 C-E
14	Pylex (3 apps.)	4.0 A-C	0.8 D-G	1.0 C-E	80 A-C	5.5 B-D
15	Pylex + Turflon Ester (2 apps.)	1.3 FG	2.0 B-D	1.8 CD	49 DE	3.8 EF
16	Pylex + Turflon Ester (3 apps.)	1.3 FG	0.5 E-G	1.8 CD	88 AB	6.5 A-C
17	Pylex + Drive XLR8 (2 apps.)	2.8 DE	2.5 BC	1.0 C-E	8 G	3.5 EF
18	Pylex + Drive XLR8 (3 apps.)	3.5 B-D	1.8 B-E	1.3 C-E	63 B-D	5.0 C-E

* WAIT – weeks after initial treatment

**Means followed by the same letter in a column are not significantly different (P=0.05).

Figure 1. General view of the study showing target weed pressure prior to application of treatments. Photo taken by P. Petelewicz on May 14, 2019. San Francisco, CA.



* Means for (A,B) English daisy control or (C) turfgrass injury, marked with blue box were significantly higher when compared to untreated control (P=0.05).

** Dark red dashed line (C) is indicating the maximal acceptable level of injury to turfgrass (score '3').

Figure 2. The effect of (A) best performing postemergence herbicide treatments on English daisy control (0-100%), (B) postemergence herbicide treatments applied 2 times on 8-wk interval (with the exclusion of UCR 002 and Sapphire at 1.5 pints/A treatments) on English daisy control (0-100%) and (C) UCR 002, UCR 003 and UCR 004 tank-mix, Sapphire at 1.5 pints/A (all applied 2 times at 8-wk interval) and Pylex alone at 1.0 oz/A (applied 3 times on a 4-wk interval) on turfgrass injury (phytotoxicity; 0-10, 10=highest), evaluated on mixed stand of perennial ryegrass (*Lolium perenne*) and annual bluegrass (*Poa annua*) in San Francisco, CA. 2019.

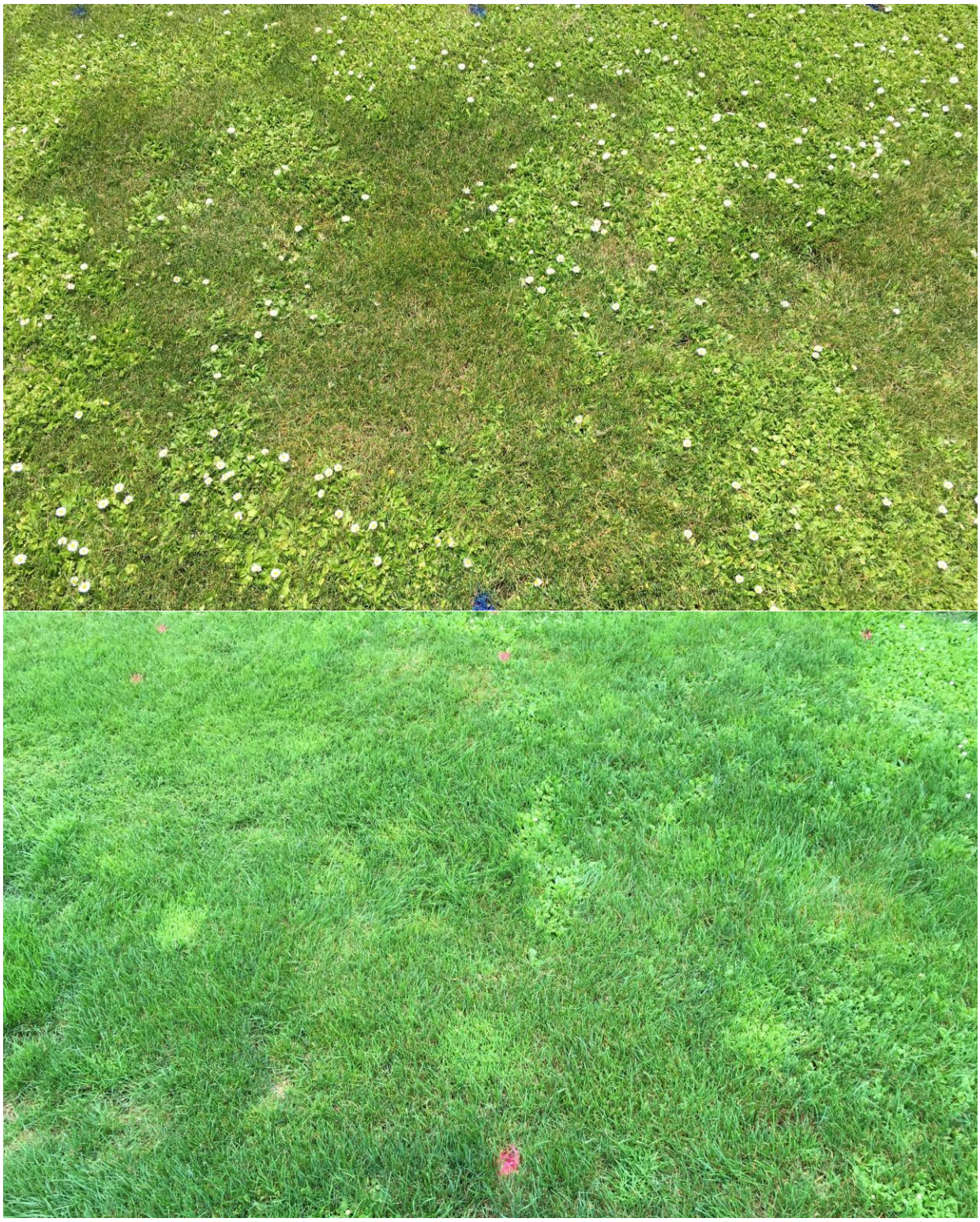


Figure 3. Comparison of plot treated with Sapphire at 1.5 pints/A (2 apps, 8-wk interval; left) to plot treated with Tenacity at 5 oz/A and Turflon Ester at 16 oz/A (3 apps, 4-wk interval; right) prior to treatment applications (above) and 14 WAIT (below). Photos taken by P. Petelewicz on May 30, 2019 (above) and September 4, 2019 (below). San Francisco, CA.

Figure 4. Comparison of plot treated with UCR 002 (treatment 5; 2 apps, 8-wk interval; left) to plot treated with Pylex at 1 oz/A and Drive XLR8 at 32 oz/A (2 apps, 8-wk interval; right) at 14 WAIT. Photo taken by P. Petelewicz on September 4, 2019. San Francisco, CA.

Figure 5. Comparison of plot treated with Tenacity at 5 oz/A (2 apps., 8-wk interval; left) to plot treated with Pylex at 1 oz/A and Turflon Ester (3 apps., 4-wk interval; right) at 14 WAIT. Photo taken by P. Petelewicz on September 4, 2019. San Francisco, CA.

Figure 6. Comparison of plot treated with Sapphire at 1.5 pints/A (2 apps., 8-wk interval; left) to plot treated with Pylex at 1 oz/A (3 apps., 4-wk interval; right) at 4 WAIT (above) and 10 WAIT (below) with some red thread (*Laetisaria fuciformis*) disease visible on both plots. Photos taken by P. Petelewicz on June 25, 2019 (above) and August 6, 2019 (below). San Francisco, CA.

Figure 7. Comparison of plot treated with Sapphire at 1.5 pints/A (2 apps, 8-wk interval; left) to plot treated with Pylex at 1 oz/A (3 apps, 4-wk interval; (right) at 10 WAIT. Photo taken by P. Petelewicz on August 6, 2019. San Francisco, CA.