Herbicidal activity of Fiesta formulations applied to turfgrass infested with broadleaf weeds – 2015 trial

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Sponsor: Neudorff North America

The objective of this research project is to evaluate the efficacy of various formulations of the sponsor's herbicide products for control of dandelions, plantain, white clover and other broadleaf weeds in established turfgrass.

MATERIALS / METHODS

Plots were located in turf research area at the Guelph Turfgrass Institute, Guelph, ON. The sites are areas of established turf (predominantly Kentucky bluegrass; some perennial ryegrass and fine fescue). Turf was maintained with typical high maintenance turf regime: 1.5 kg actual N 100 m^{-2} per year in 3 applications (spring, summer, dormant); P and K in a 4:1:4 ratio with N; irrigated to prevent stress prior to treatment application and to prevent dormancy thereafter; mowed at 3 inches.

The treatments were combinations of different rates and volumes of post-emergent herbicide, as well as controls for a total of 6 treatments (see Table 1). Each treatment was replicated four times in 1 x 2 m plots arranged in a randomized complete block design (Figure 1). Treatments were applied July 23, 2015, and reapplied August 6, 2015 (Fiesta treatments). Treatments were applied with a compressed air sprayer (Teejet 8001VS flat fan nozzles - 5 ml sec^{-1} $nozzle^{-1}$ at 20 psi). Turf was mowed 3 days prior to treatment. Turf was well watered prior to application, and irrigation/rainfall withheld for 24 hours after application.

An anecdotal photographic record of the experiment was kept.

All measurements were analysed by appropriate statistical analyses (general linear models).

Data Collection:

Plots were rated pre-treatment for weed presence by visual ratings of broadleaf weed density and point quadrat measurement of weed cover. Post-treatment measurements of weeds were taken at 2-3 weeks after last treatment. Plots were rated visually and using canopy reflectance (normalized-difference vegetation index) 2-3 days after treatment for phytotoxicity of treatments to broadleaf weeds and to grasses.

Environmental conditions were noted at treatment application and for 24 hours following.

RESULTS

Environmental data

Daily air temperatures, evapotranspiration demand, and rainfall data for summer 2015 are presented in Figures 2 - 4.

Table 1. Treatments

Treatment	Active ingredient	Dilution	Application rate (ml m^{-2})
1 11-73-1 low	Fe chelate	4%	200
2 11-73-1 high	Fe chelate	4%	400
3 11-73-2 low	Fe chelate	—	200
4 11-73-2 high	Fe chelate	—	400
5 Positive control	Par III	per label	per label
6 Control	—	—	—

Figure 1. Plot area July 21, 2015 (pretreatment).
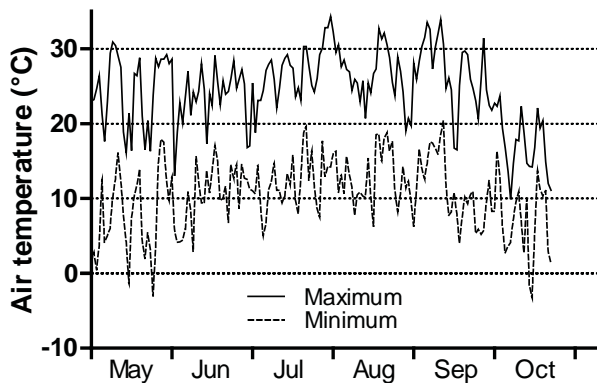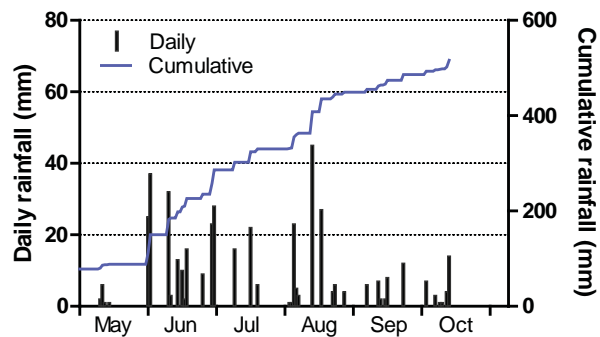

Figure 2. Daily air temperatures at GTI, summer 2015.

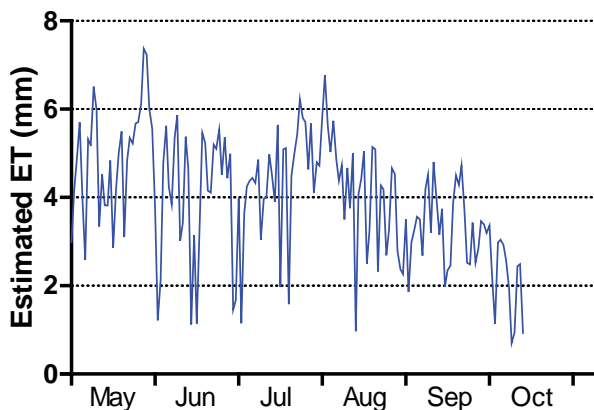Figure 4. Daily and cumulative rainfall at GTI, summer 2015.

Phytotoxicity immediately post-treatment.

There was evidence on broadleaf weeds of blackened leaves and necrosis within a day after treatment, and the differences were significant by 4 DAT (Table 2). There was no evidence of phytotoxicity on grasses 4 DAT, but some slight but not significant effects occurred later in the experiment. Patterns of phytotoxic effects on weeds were generally not statistically significant among herbicide treatments, though there was a suggestion of a rate effect in the Fiesta treatments.

Canopy reflectance.

Canopy reflectance, which can be correlated with photosynthetic activity and plant health, was

Figure 3.   Daily estimated ET at GTI, summer 2015.

Table 2. Visual ratings of phytotoxicity in treated plots.

Treatment	Weed		Grass	
	4 DAT	19/5 DAT	4 DAT	19/5 DAT
11-73-1 high	4.8[1] a	1.8 ab	0.0	0.3
11-73-1 low	3.3 a	0.8 b	0.0	0.0
11-73-2 high	5.0 a	2.5 ab	0.0	1.0
11-73-2 low	3.3 a	1.8 ab	0.0	0.5
Control	0.0 b	0.3 b	0.0	0.0
Par III	4.0 a	3.5 a	0.0	0.0
msd p=0.05	1.9	2.3	NS	NS

[1] Visual ratings 0-10, 10 = most phytotoxicity. Means of 4 replicates. Means within columns followed by the same letter are not significantly different (Tukey's HSD test, p=0.05).

reduced by all treatments relative to the control (Table 3). There statistically significant differences among treatments on all early post treatment dates, with the general pattern being similar to the visual phytotoxicity data. By 12 weeks after the last treatment the canopy reflectance differences had disappeared. The reduction in all treatments is a combination of death of the weed species and the phytotoxicity to the grasses.

Broadleaf weed control.

Broadleaf weed infestation in the plot area before treatment was about 23.5% of the area, as estimated by point-quadrat counts (Table 4). This is roughly equivalent to a visual rating of 5 (Table 5). Most of the weed present was dandelion and white clover, with smaller amounts of broadleaf plantain, chickweed, field bindweed and black medick.

Table 4. Total plot area (percent) covered by weed species.

Treatment	Total weed			Dandelion		Clover		Broadleaf plantain		Chickweed		Bindweed		Black medick	
	Pre[1]	Post[2]	Change	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
11-73-1 high	19.5[3]	2.3 b	-17.2 b	5.3	2.0 ab	11.8	0.3 b	2.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
11-73-1 low	19.3	4.0 b	-15.3 b	3.3	1.3 ab	16.0	2.7 b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-73-2 high	26.8	11.3 b	-15.4 b	4.3	4.7 ab	21.3	6.3 b	0.8	0.3	0.3	0.0	0.3	0.0	0.0	0.0
11-73-2 low	21.0	8.7 b	-12.3 b	4.8	4.0 ab	16.3	4.7 b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control	26.0	35.7 a	9.7 a	7.8	7.0 a	16.5	26.7 a	1.3	2.0	0.3	0.0	0.3	0.0	0.0	0.0
Par III	28.8	0.0 b	-28.8 b	5.5	0.0 b	20.3	0.0 b	2.0	0.0	0.3	0.0	0.0	0.0	0.8	0.0
msd p=0.05	NS	13.6	16.8	NS	6.6	NS	11.8	NS	NS	NS	NS	NS	NS	NS	NS

[1,2] Pretreatment counts were taken prior to the first application; post-treatment counts were taken August 26, 2015 (20 days after the reapplication of treatments).
[3] Percent cover area estimated by point-quadrat weed counts: 75 points per plot x 4 replicates. Means within columns followed by the same letter are not statistically significantly different (Tukey's HSD, p=0.05).

Table 5. Visual ratings of weed presence

Treatment	Total weed					Dandelion				Clover				Broadleaf plantain			
	Pre	13 DAT	19/5	35/21	89/75	Pre	13 DAT	19/5	35/21	Pre	13 DAT	19/5	35/21	Pre	13 DAT	19/5	35/21
11-73-1 high	4.5[1]	1.5 b	0.6 b	2.0 bc	1.8 b	1.3	0.8	0.0 b	1.5 a	2.5	3.3	0.1 b	0.6 b	1.3	1.5	0.5	0.4
11-73-1 low	4.5	3.0 b	0.8 b	2.0 bc	2.0 b	1.8	0.8	0.3 b	1.5 a	3.3	2.0	0.8 b	1.5 b	0.5	1.0	0.1	0.3
11-73-2 high	5.5	3.5 b	1.3 b	3.3 b	2.5 ab	1.8	1.0	0.1 b	1.8 a	4.0	3.8	1.1 b	2.0 b	1.5	0.8	0.6	1.0
11-73-2 low	4.3	3.0 b	1.6 b	2.5 bc	2.3 b	1.8	1.3	0.4 b	1.3 ab	2.5	2.5	1.4 b	2.0 b	0.8	0.5	0.5	0.6
Control	5.5	6.8 a	5.3 a	6.3 a	4.3 a	1.3	1.3	1.8 a	1.5 a	2.5	1.8	4.3 a	5.3 a	1.5	1.0	1.3	1.3
Par III	5.5	2.5 b	1.8 b	0.3 c	0.6 b	1.5	0.8	0.3 b	0.3 b	3.3	1.5	0.6 b	0.0 b	1.5	1.0	1.1	0.0
msd p=0.05	NS	2.1	2.6	2.3	1.9	NS	NS	0.7	1.1	NS	NS	1.4	2.3	NS	NS	NS	NS

[1] Visual ratings 0-10, 10 = most weed. Means of 4 replicates. Means within columns followed by the same letter are not significantly different (Tukey's HSD test, p=0.05).

There was significant reduction in total broadleaf weed by 2 weeks after the second treatment (from 23.5% to 5.3%). There were differences among the treatments, but these were generally not significantly different. Treatments controlled dandelion and clover effectively, though the reduction of clover was more pronounced, as it started at higher coverage.

DISCUSSION AND CONCLUSIONS

All experimental treatments provided some broadleaf weed control of all the target species, whether estimated by point-quadrat cover ratings or visual weed ratings. There were no clear patterns among the herbicide treatments, though the positive control (Par III) had slightly less weed than the Fiesta treatments. Visual ratings generally matched the point-quadrat data. There was a slight rate effect in the visual ratings of weed phytotoxicity and weed presence, but this was not statistically signiricant.