Herbicidal activity of NEU1173H applied to turfgrass infested with dandelion, broadleaved plantain, and white clover – Spring 2011 trial

K. Carey, A.J. Porter, E.M. Lyons and K.S. Jordan

Department of Plant Agriculture and the Guelph Turfgrass Institute,
University of Guelph, Ontario.

MATERIALS/METHODS

This is the second year of a trial begun in 2010. Plots were located in the turf research area at the Guelph Turfgrass Institute, Guelph, ON. The site is an area of established turf (predominantly Kentucky bluegrass; some perennial ryegrass and fine fescue) (Figure 1). 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 2 x 2 m plots arranged in a randomized complete block design. Treatments were applied June 9, 2011, and reapplied July 5, 2011. Treatments were applied with a compressed air sprayer (20 psi, Teejet 8001VS flat fan nozzles, 20 ml sec^{-1}). Turf was mowed 2-3 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- and post-treatment for turf color and quality, using visual assessments and canopy reflectance (normalized-difference vegetation index). Weed presence was assessed pre- and post-treatment with point-quadrat counts and visual ratings.

Phytotoxicity of treatments to plots (turfgrass and weeds) was assessed by visual ratings and NDVI.

RESULTS

Phytotoxicity – visual ratings. There was some phytotoxicity on the turfgrass as assessed by visual ratings in treated plots 1 DAT (Table 2), but it was slight and had disappeared by 2 weeks after the treatment. The repeat application had no effect on turfgrasses. Phytotoxicity to the

Figure 1. Plot area October 7, 2011.

Table 1. Treatments

Treatment		Dilution Rate	Application rate (ml m^{-2})
1	Control	—	—
5	NEU1173H (0.25 g a.i. m^{-2})	NEU 1173H:water 24:1	100
2	NEU1173H (0.5 g a.i. m^{-2})	NEU 1173H:water 24:1	200
3	NEU1173H (1 g a.i. m^{-2})	NEU 1173H:water 24:1	400
6	NEU1173+S (0.25 g a.i. m^{-2})	NEU 1173H:water 24:1 (+adjuvant S - 0.1%)	100
4	Killex (0.55 ml m^{-2})		100

Table 2. Visual ratings of phytotoxicity of treatments

Treatment	Grass	Broadleaf weeds
	06/10 (1 DAT)	06/21 (12 DAT)
Control	0.0 c	3.3 c
Killex	2.5 ab	8.5 a
NEU1173+S	2.0 b	7.3 ab
NEU1173H-100	1.8 b	6.8 b
NEU1173H-200	2.5 ab	7.8 ab
NEU1173H-400	3.8 a	8.8 a
msd p=0.05	1.7	1.7

[1] Visual ratings 0-10, 0 = no toxicity. Effects on grass were slight necrosis of foliage; no adverse effects on color, uniformity, or density were noted. Means of four replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

broadleaf weeds in the plots was more pronounced, but differences among the treatments were slight.

Phytotoxicity – canopy reflectance. Canopy reflectance, which can be correlated with photosynthetic activity and plant health, was not significantly affected by any treatments relative to the control (Table 3). This is quite a different pattern from the previous year's data, which showed a significant decline in NDVI associated with treatment applications (Figure 2). It is likely that the decline in 2010 was a result of death of weeds, which contributed to the higher canopy reflectance in the control plots. In 2011, since the weed pressure was much lower pretreatment, there was not an equivalent decline. There was no apparent rate effect in the experimental treatments.

Weed infestation and control – point quadrat estimares and visual ratings. The reduction in weed presence from the first year of treatment carried over to the plots in 2011. While there was about 35% broadleaf weed cover before the first treatment in 2010, there was less than 10% weed cover pretreatment in non control plots in 2011 (Table 4). The control plots had about 28% broadleaf weed. The pattern in the visual ratings (Table 5) was similar to the point-quadrat measurements. The predominant weed pressure both in the control and treated plots was from clover, with smaller amounts of dandelion and broadleaved plantain.

DISCUSSION AND CONCLUSIONS

There was considerable residual effect of the herbicide treatments from 2010 in the plots pretreatment in 2011, with less than 10% weed at the beginning of the season, compared to 35% in 2010. Because the starting weed pressure was low, most of the significant difference in 2011 data was between the untreated control and the treated plots as a group. There were few significant differences among the treatments apart from a slight rate effect in the control of broadleaved plantain.

The phytotoxicity of the treatments to weeds which was evident in the visual ratings was not detected in the canopy reflectance data, presumably because the percent cover of the broadleaf weeds was small. There was no overall decline in canopy reflectance associated with the treatments as was seen in 2010.

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Table 3. Canopy reflectance (NDVI) and change in canopy reflectance relative to untreated control (ΔNDVI) in treated plots

Treatment	05/05	05/25	06/06	06/10	06/13	06/14	06/15	06/17
	-35	-15	-3	1 DAT	4	5	6	8
				NDVI				
Control	0.623[1]	0.595	0.628	0.615	0.607	0.580	0.579	0.614
Killex	0.607	0.585	0.620	0.598	0.587	0.582	0.597	0.598
NEU1173+S	0.644	0.586	0.618	0.587	0.573	0.575	0.564	0.591
NEU1173H-100	0.625	0.570	0.624	0.618	0.610	0.602	0.602	0.624
NEU1173H-200	0.622	0.595	0.622	0.617	0.606	0.594	0.598	0.625
NEU1173H-400	0.644	0.590	0.627	0.617	0.613	0.595	0.600	0.631
msd p=0.05	NS	NS	NS	NS	NS	NS	NS	NS
				ΔNDVI				
Killex	-0.016[2]	-0.010	-0.009	-0.017	-0.021	0.002	0.016	-0.017
NEU1173+S	0.020	-0.009	-0.010	-0.029	-0.035	-0.004	-0.017	-0.024
NEU1173H-100	0.002	-0.026	-0.004	0.002	0.001	0.023	0.022	0.009
NEU1173H-200	-0.001	-0.001	-0.006	0.001	-0.003	0.015	0.018	0.010
NEU1173H-400	0.021	-0.005	-0.001	0.001	0.004	0.016	0.019	0.016
msd p=0.05	NS	NS	NS	NS	NS	NS	NS	NS
	06/27	06/29	07/05	07/06	07/14	07/22	08/05	08/26
	18	20	Reapp	1 DAT	9	17	31	53
				NDVI				
Control	0.656	0.642	0.641	0.612	0.538	0.479	0.499	0.542
Killex	0.642	0.625	0.628	0.598	0.592	0.543	0.523	0.522
NEU1173+S	0.637	0.623	0.620	0.585	0.551	0.498	0.527	0.579
NEU1173H-100	0.656	0.636	0.641	0.627	0.596	0.544	0.559	0.594
NEU1173H-200	0.664	0.642	0.648	0.620	0.593	0.554	0.527	0.575
NEU1173H-400	0.667	0.649	0.655	0.642	0.568	0.520	0.523	0.595
msd p=0.05	NS	NS	NS	NS	NS	NS	NS	NS
				ΔNDVI				
Killex	-0.014	-0.017	-0.012	-0.013	0.054	0.064	0.023	-0.021
NEU1173+S	-0.019	-0.019	-0.021	-0.027	0.013	0.020	0.027	0.037
NEU1173H-100	0.000	-0.006	0.000	0.016	0.057	0.066	0.059	0.051
NEU1173H-200	0.008	-0.001	0.007	0.008	0.054	0.075	0.027	0.032
NEU1173H-400	0.011	0.007	0.014	0.031	0.029	0.041	0.023	0.052
msd p=0.05	NS	NS	NS	NS	NS	NS	NS	NS

[1] Normalized-difference vegetation index; means of 40-50 readings x 4 replicates.

[2]Change in NDVI relative to control plot means; means of 40-50 readings x 4 replicates.

Means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

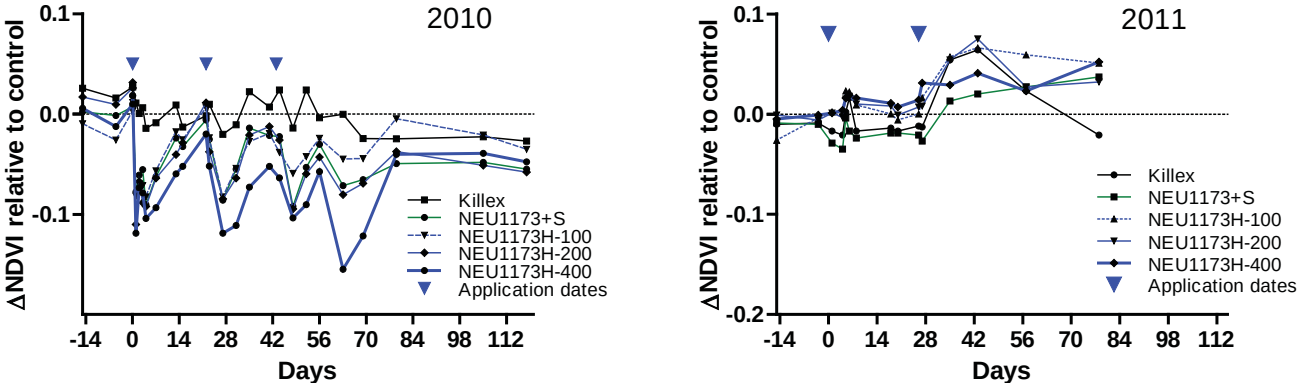

Figure 2. Changes in canopy reflectance relative to control plots, 2010 (left) and 2011 (right).

Table 4. Percent area covered by total weeds, and the three most common weed species, estimated by point-quadrat counts.

Treatment	—Total weed —		— Dandelion —		— Plantain —		— Clover —	
	05/24	06/10	05/24	06/10	05/24	06/10	05/24	06/10
Control	39.5 a[1]	28.3 a	6.5	6.3 a	2.8	5.3 a	30.3 a	16.0 a
Killex	9.8 b	12.8 b	5.3	3.0 ab	0.0	2.5 ab	4.5 b	6.8 b
NEU1173+S	8.3 b	8.0 b	5.0	1.8 ab	1.5	2.3 ab	1.8 b	4.0 b
NEU1173H-100	8.8 b	9.5 b	3.0	1.5 ab	1.3	2.3 ab	4.5 b	5.9 b
NEU1173H-200	8.8 b	9.3 b	5.8	0.5 b	1.5	0.5 b	1.5 b	8.0 ab
NEU1173H-400	3.8 b	5.3 b	3.8	0.5 b	0.0	2.3 ab	0.0 b	1.8 b
msd p=0.05	17.6	14.8	NS	4.8	NS	4.0	14.6	8.4

[1]Point-quadrat count of 75 points x 4 replicates. Means of 4 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

Table 5. Visual ratings of weed presence.

Treatment	Total weed			Dandelion		
	05/25	06/10	06/21	05/25	06/10	06/21
Control	6.0 a[1]	5.3 a	6.8 a	1.3	0.8	0.8
Killex	2.0 b	1.5 b	1.0 b	1.0	1.0	0.5
NEU1173+S	1.8 b	1.3 b	1.8 b	1.0	0.8	0.8
NEU1173H-100	2.0 b	1.5 b	1.8 b	0.8	0.8	0.8
NEU1173H-200	1.5 b	0.8 b	1.3 b	1.0	1.0	0.8
NEU1173H-400	1.0 b	1.0 b	1.0 b	1.0	0.5	1.0
msd p=0.05	2.8	2.0	2.3	NS	NS	NS
	Plantain			Clover		
	05/25	06/10	06/21	05/25	06/10	06/21
Control	1.5	2.0 a	2.0 a	4.8 a	3.5 a	5.5 a
Killex	0.5	0.5 b	0.3 c	1.5 b	1.3 b	0.8 b
NEU1173+S	1.0	1.0 ab	1.5 ab	0.5 b	0.0 b	1.0 b
NEU1173H-100	1.0	1.0 ab	1.3 abc	1.8 b	0.8 b	1.3 b
NEU1173H-200	0.8	0.5 b	0.8 bc	0.8 b	0.3 b	1.0 b
NEU1173H-400	0.3	0.5 b	0.3 c	0.3 b	0.0 b	0.0 b
msd p=0.05	NS	1.2	1.1	3.0	1.3	2.2

[1] Visual rating 0-10, 0 = no weed, 10 = complete weed cover. Means of 4 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).