Efficacy of PC Turf herbicide product (concentrate and ready-to-use) at different application rates – 2008 trial.

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MATERIALS/METHODS

Plots were located in turf research area at the Guelph Turfgrass Institute, Guelph, ON (Figure 1). The site is an area of established turf (predominantly turf-type perennial ryegrass, infested with dandelion, clover and other lawn weeds). Turf was maintained with typical medium maintenance turf regime: 1.5 kg actual N 100 m^{-2} per year in 2 applications (spring, summer); 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 of ready-to-use and concentrate formulations of pre-emergent herbicide and adjuvant, as well as controls for a total of 12 treatments (see Table 1). Each treatment was replicated four times in 1 x 2 m plots arranged in a randomized complete block design. Plots were separated by 0.5 m buffer strips. Treatments were applied June 18, 2008. Treatments were applied with a compressed air sprayer (100 ml m^{-2} spray volume; flat fan nozzles).

Data collected included pre- and post-treatment visual ratings of broadleaf weed cover, point-quadrat weed cover estimates, and post-treatment ratings of phytoxicity to vegetation in the plots. Phytotoxicity was estimated by visual ratings and by turf canopy reflectance spectrometry using a Greenseeker normalized difference vegetation index (NDVI) meter.

An anecdotal photographic record of the experiment was kept.

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

RESULTS

Quality ratings and phytotoxicity of treatments. There was little phytotoxicity apparent in any of the treatments (Table 2). There were some differences in quality 5 days after treatment, but the range of quality ratings was quite narrow, and all treatments were in the acceptable range.

Table 1. Treatments

Treatment	Product	Appl. Rate ml m^{-2}	Dilution rate
1	Killex Conc.	.55 ml m^{-2} in 100 ml	
2	PC WW0, Conc.	60	0.1
3	PC WW0, RTU	60	—
4	PC WW1, Conc	30	0.128
5	PC WW1, Conc	60	0.064
6	PC WW1, Conc	100	0.064
7	PC WW1, Conc	120	0.032
8	PC WW1, Conc	150	0.064
9	PC WW1, RTU	60	—
10	PC WW1, RTU	100	—
11	PC WW2, Conc	60	0.064
12	PC WW2, Conc	100	0.064
13	PC WW2, RTU	60	—
14	Untreated control	—	—

Figure 1. Plot layout in weedy turf for herbicide rate trial.

Table 2. Visual ratings of treated plots.

Treatment	Weed rating[1]			Phytotoxicity[2]	Phenoxy effect[3]	Quality[4]	
	5 DAT	15 DAT	51 DAT	5 DAT	5 DAT	5 DAT	15 DAT
Control	4.0	4.5 a	7.0 a	0.5	0.0	7.0 bc	5.0
WW0 Conc 60	2.3	1.3 bcd	3.0 b	1.5	0.1	7.0 bc	6.5
WW0 RTU 60	2.3	1.5 bcd	2.8 bc	1.5	0.1	7.0 bc	6.0
WW2 Conc 60	2.8	2.0 bc	2.8 bc	0.8	0.1	7.3 b	6.5
WW1 Conc 120	3.0	2.3 b	2.8 bc	1.5	0.1	7.0 bc	6.0
WW1 Conc 60	3.3	1.8 bcd	2.0 bcd	1.0	0.1	7.0 bc	6.5
WW1 Conc 30	3.0	1.5 bcd	1.8 bcd	1.5	0.1	7.0 bc	6.5
WW1 RTU 60	2.3	0.8 d	1.5 bcd	1.5	0.3	6.8 cd	6.5
WW1 Conc 100	2.8	1.5 bcd	1.5 bcd	1.5	0.3	7.0 bc	6.3
WW2 Conc 100	2.8	1.5 bcd	1.5 bcd	1.5	0.1	7.0 bc	6.0
WW2 RTU 60	2.5	1.0 cd	1.3 cd	1.5	0.1	7.0 bc	6.5
WW1 RTU 100	2.3	0.8 d	1.0 d	1.3	0.1	7.0 bc	6.8
WW1 Conc 150	2.3	1.5 bcd	1.0 d	1.3	0.3	6.5 d	6.5
Killex Conc 100	4.0	1.3 bcd	0.7 d	3.0	0.1	7.7 a	6.3
lsd p=0.05	NS	1.15	1.52	NS	NS	0.40	NS

[1]Visual rating of weed infestation 0-10, 0=no weed, 10=~50% weed cover.
[2]Visual rating of phytotoxicity 0-10; blackening of leaves of broadleaf weeds.
[3]Curling of leaves or petioles of broadleaf weeds, rated on a scale of 0-2.
[4]Visual rating of turf quality 0-10, 6=acceptable, 10=best.
Means of 4 replicates; means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).

Quality as estimated by canopy reflectance. The pattern in the canopy reflectance as measured by the normalized-difference vegetation index was significant for most observation dates (Table 3). There was a general decline in NDVI for all treatments relative to the control, and a general decline in canopy reflectance for the whole experimental area over the season. Within the treated plots, the pattern of canopy reflectance reduction was similar to the pattern of weed control, but not consistently so (see below). It is not possible with this experimental design to separate the effects of loss of broadleaf vegetation cover and phytotoxic effects on the grass species in their effects on NDVI. Both effects would tend to reduce the index.

Table 3. Canopy reflectance readings from treated plots.

Treatment	Days after treatment						
	-28	-24	-13	-11	-6	-4	-3
Control	0.823[1] abcd	0.829	0.841 bcde	0.849 abcd	0.773 bcde	0.753 def	0.771 f
WW1 Conc 60	0.810 de	0.833	0.854 ab	0.858 a	0.793 a	0.776 ab	0.830 a
WW0 Conc 60	0.824 abc	0.833	0.845 abcd	0.846 bcd	0.777 bc	0.765 bcd	0.827 ab
WW2 Conc 60	0.830 ab	0.833	0.832 defg	0.844 cde	0.759 ef	0.772 ab	0.794 e
WW0 RTU 60	0.827 abc	0.839	0.840 cdef	0.850 abcd	0.766 cdef	0.755 def	0.813 bcd
WW2 RTU 60	0.835 a	0.841	0.841 bcde	0.845 bcd	0.774 bcd	0.771 abc	0.823 abc
WW1 Conc 150	0.826 abc	0.839	0.843 abcde	0.848 abcd	0.787 ab	0.786 a	0.835 a
WW1 Conc 30	0.828 ab	0.835	0.847 abc	0.852 abc	0.775 bcd	0.765 bcd	0.828 ab
WW2 Conc 100	0.825 abc	0.827	0.846 abc	0.855 abc	0.774 bcd	0.756 cde	0.832 a
WW1 Conc 100	0.829 ab	0.832	0.849 abc	0.849 abcd	0.787 ab	0.767 bcd	0.835 a
WW1 RTU 60	0.805 e	0.817	0.826 fg	0.825 f	0.753 f	0.734 g	0.808 cde
Killex Conc 100	0.808 e	0.828	0.856 a	0.855 ab	0.795 a	0.778 ab	0.795 e
WW1 Conc 120	0.817 bcde	0.835	0.830 efg	0.840 de	0.762 def	0.747 efg	0.804 de
WW1 RTU 100	0.814 cde	0.829	0.818 g	0.834 ef	0.753 f	0.739 fg	0.805 de
lsd p=0.05	0.014	NS	0.014	0.011	0.015	0.016	0.015

	-2	3	5	10	11	12	16
Control	0.759 f	0.717 a	0.818 de	0.877 bc	0.739 a	0.628 def	0.684 a
WW1 Conc 60	0.798 a	0.693 bc	0.843 ab	0.872 bc	0.713 de	0.618 fg	0.640 bcd
WW0 Conc 60	0.789 abc	0.682 cde	0.839 abc	0.906 a	0.732 ab	0.627 ef	0.633 cde
WW2 Conc 60	0.770 def	0.682 cde	0.846 a	0.878 bc	0.722 bcde	0.635 cde	0.647 b
WW0 RTU 60	0.780 cd	0.683 cde	0.824 bcde	0.872 bc	0.740 a	0.627 ef	0.638 bcde
WW2 RTU 60	0.782 bcd	0.673 ef	0.849 a	0.874 bc	0.720 cde	0.673 a	0.631 cdef
WW1 Conc 150	0.799 a	0.696 bc	0.822 bcde	0.863 c	0.711 e	0.643 bcd	0.639 bcd
WW1 Conc 30	0.790 abc	0.687 bcd	0.783 g	0.867 c	0.740 a	0.651 b	0.643 bc
WW2 Conc 100	0.790 abc	0.672 ef	0.820 cde	0.876 bc	0.724 bcd	0.636 cde	0.625 ef
WW1 Conc 100	0.794 ab	0.677 def	0.835 abcd	0.874 bc	0.719 cde	0.607 g	0.625 ef
WW1 RTU 60	0.765 ef	0.670 f	0.811 ef	0.885 b	0.718 de	0.635 cde	0.627 def
Killex Conc 100	0.777 cde	0.693 bc	0.829 abcde	0.841 d	0.720 cde	0.648 bc	0.627 def
WW1 Conc 120	0.769 def	0.679 def	0.795 fg	0.865 c	0.720 cde	0.638 bcde	0.617 fg
WW1 RTU 100	0.772 def	0.650 g	0.786 g	0.872 bc	0.730 abc	0.628 def	0.607 g
lsd p=0.05	0.014	0.012	0.021	0.016	0.011	0.015	0.014

	17	24	26	37	45	57	Mean
Control	0.683 a	0.706 a	0.697 a	0.696 a	0.727 a	0.721 a	0.75
WW1 Conc 60	0.637 bcd	0.649 bc	0.650 bcd	0.650 cd	0.659 bcd	0.638 cd	0.731
WW0 Conc 60	0.638 bc	0.651 b	0.644 bcde	0.646 cde	0.662 bc	0.647 bc	0.729
WW2 Conc 60	0.645 b	0.655 b	0.659 b	0.661 b	0.670 b	0.654 b	0.728
WW0 RTU 60	0.642 bc	0.653 b	0.649 bcd	0.651 cd	0.664 bc	0.638 cd	0.725
WW2 RTU 60	0.635 bcd	0.652 b	0.645 bcde	0.648 cd	0.655 cde	0.629 def	0.724
WW1 Conc 150	0.642 b	0.651 b	0.657 bc	0.654 bc	0.660 bc	0.621 ef	0.724
WW1 Conc 30	0.642 b	0.650 b	0.648 bcd	0.639 efg	0.642 f	0.622 ef	0.723
WW2 Conc 100	0.626 cde	0.651 b	0.643 bcde	0.645 def	0.660 bc	0.631 de	0.722
WW1 Conc 100	0.620 ef	0.635 de	0.634 de	0.637 fgh	0.649 def	0.628 ef	0.721
WW1 RTU 60	0.619 ef	0.636 cd	0.645 bcde	0.644 defg	0.649 ef	0.628 ef	0.712
Killex Conc 100	0.625 de	0.622 e	0.642 cde	0.617 i	0.622 g	0.604 g	0.711
WW1 Conc 120	0.620 ef	0.626 de	0.630 e	0.628 h	0.642 f	0.619 f	0.709
WW1 RTU 100	0.608 f	0.628 de	0.629 e	0.636 gh	0.649 ef	0.622 ef	0.707
lsd p=0.05	0.013	0.014	0.017	0.009	0.01	0.01	

[1]Normalized-difference vegetation index. Mean of 15-20 readings x 4 replicates (before 26 DAT) or 30-40 readings x 4 replicates thereafter. Treatments are ordered based on overall season mean from highest (Control) to lowest (WW1 RTU 100).

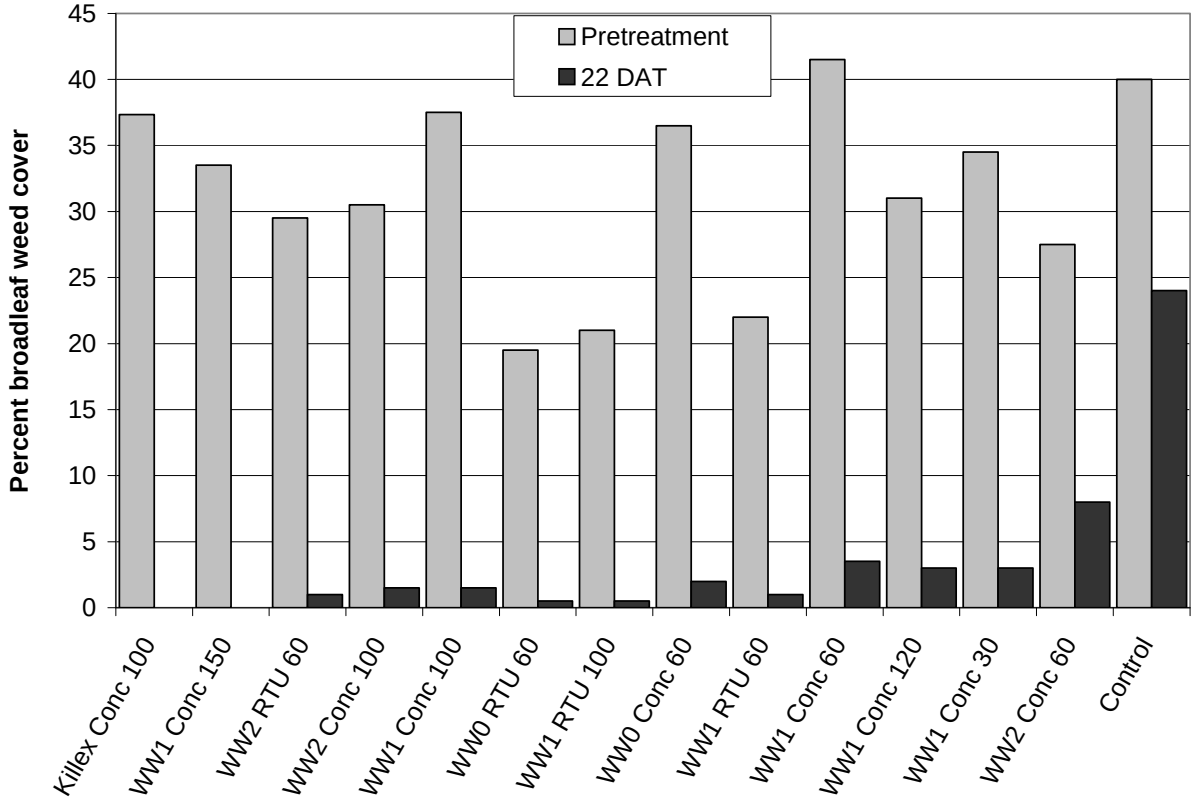

Figure 1. Pre-treatment and post-treatment (22 DAT) broadleaf weed cover in plots. Means of four replicate plots.

Broadleaf weed control. There was a significant decrease total weed cover estimated visually (Table 2). The WW0 treatments and two of the other treatments resulted in slightly poorer control; the rest of the treatments were statistically identical, thought the Killex treatment and two WW1 high concentration treatments gave the best control numerically. The point quadrat weed cover data showed good weed control (>80% control) in all treatments except WW2 concentrate at 60 ml m^{-2} (Table 4, Figure 2). There was a slight rate effect, with higher rates generally giving better control, but the effect was not consistent, and the differences were not statistically significant. Most of the weed control was observed in the species that were present in appreciable cover percentages (dandelion, and clover), though birdsfoot trefoil was also controlled.

DISCUSSION AND CONCLUSIONS

Most of the experimental treatments reduced the broadleaf weed cover as well as the Killex standard. The one exception was WW2 concentrate at 60 ml m^{-2}, which, despite being statistically less effective, still gave a 72% reduction in broadleaf weeds relative to the pretreatment levels. Six experimental treatments gave 95% or better reduction of broadleaf weed cover.

There was no significant visible phytotoxicity of any treatments on the grass, though there was some reduction in canopy reflectance, which may indicate general stress to the vegetation in all treatments.

Sponsor: PetroCanada

Table 4. Percent weed cover estimated by point-quadrat methods in treated plots pre- and post-treatment.

Treatment	Dandelion		Clover		Birdsfoot trefoil		Black medic		Hawkweed		Chickweed		Bare soil		Grass		Total weed		Percent weed reduction
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	
Killex Conc 100	32.7[1]	0.0 c	4.7	0.0 b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	6.0	60.7	88.0 ab	37.3	0.0 c	100.0 a
WW1 Conc 150	31.0	0.0 c	1.5	0.0 b	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	3.3	64.0	93.5 ab	33.5	0.0 c	100.0 a
WW2 RTU 60	20.0	0.5 c	4.5	0.0 b	4.5	0.3	0.0	0.0	0.0	0.0	0.5	0.0	1.0	4.0	69.5	91.0 ab	29.5	1.0 c	97.1 a
WW2 Conc 100	20.5	1.0 c	4.0	0.0 b	5.0	0.3	1.0	0.0	0.0	0.0	0.0	0.0	1.5	4.5	68.0	89.5 ab	30.5	1.5 c	96.8 a
WW1 Conc 100	24.0	1.0 c	4.0	0.0 b	3.0	0.3	0.0	0.0	5.5	0.0	1.0	0.0	1.0	5.0	61.5	88.5 ab	37.5	1.5 c	95.8 a
WW0 RTU 60	17.5	0.5 c	2.0	0.0 b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.8	78.5	94.0 ab	19.5	0.5 c	95.0 a
WW1 RTU 100	19.5	0.5 c	1.5	0.0 b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.8	78.5	94.0 ab	21.0	0.5 c	95.0 a
WW0 Conc 60	25.5	0.5 c	5.0	0.0 b	3.0	0.0	0.0	0.5	3.0	0.3	0.0	0.0	0.5	1.5	63.0	95.0 a	36.5	2.0 c	93.2 ab
WW1 RTU 60	14.5	0.5 c	3.5	0.0 b	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	3.3	77.0	92.5 ab	22.0	1.0 c	92.2 ab
WW1 Conc 60	35.0	2.0 bc	3.5	0.0 b	2.5	0.0	0.0	0.8	0.0	0.0	0.5	0.0	1.5	3.5	57.0	89.5 ab	41.5	3.5 bc	90.6 ab
WW1 Conc 120	27.5	3.0 bc	3.0	0.0 b	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	65.0	89.0 ab	31.0	3.0 bc	87.9 ab
WW1 Conc 30	25.5	2.5 bc	2.0	0.0 b	7.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	3.0	1.5	62.5	94.0 ab	34.5	3.0 bc	83.1 ab
WW2 Conc 60	24.5	5.0 b	1.5	1.0 b	0.5	0.5	0.0	0.5	0.0	0.0	1.0	0.0	1.0	3.3	71.5	85.5 b	27.5	8.0 b	72.2 b
Control	37.5	13.0 a	2.5	7.0 a	0.0	0.3	0.0	1.5	0.0	0.0	0.0	0.3	4.0	1.3	56.0	73.5 c	40.0	24.0 a	37.2 c
lsd p=0.05	NS	3.3	NS	1.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	9.2	NS	5.8	22.4

[1] Percent cover of weeds estimated by point-quadrat method; 100 points per plot. Means of 4 replicates; means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).