EVALUATION OF NATURAL SELECTIVE POST-EMERGENT HERBICIDE PRODUCTS ON GROWTH AND SURVIVAL OF WEEDS AND TURFGRASS.

K. Carey and E. Gunn
Department of Plant Agriculture and the Guelph Turfgrass Institute,
University of Guelph, Ontario.

Sponsor: Loblaw Brands Limited

Objective

The objective of this research project was to determine the effect of the sponsor's products on survival, shoot and root growth of typical weeds of cool season turfgrass, as well as on desirable turfgrass species (Kentucky bluegrass, perennial ryegrass, and fine fescue).

Data collected included observation of the survival rate relative to untreated controls of treated plants, the total shoot and root growth of plants following treatment with post-emergent herbicide products.

Experimental Design / Methods

The treatments were 2 experimental products (EcoSafe and Weed Zap) applied at label rates, a standard post-emergent synthetic herbicide treatment (Par III mecoprop/2,4-D/dicamba), and an untreated control. Twelve weed species and 3 fine turfgrass species were planted, but only 7 weed species, and 2 turfgrass species had sufficient germination to be included in the design (see Table 1). Each treatment was replicated five times in 2 cm diameter x 11 cm deep plastic forestry tubes filled to the rim with 80:20 v/v USGA:peatmoss rootzone mix. Seeding rate was 20 seeds per pot for all species. Treatments were placed in a randomized complete block plot layout in the greenhouses at the Bovey Bldg., University of Guelph (Figure 1).

Table 1. Treatments

Factor 1	Post emergent herbicide product
	Control (no treatment)
	Ecosafe
	WeedZap
	Synthetic standard 3-way phenoxy post-emergent herbicide (Par III)
Factor 2	Plant species
	Weed species
	Black medic *(Medicago lupulina)*
	Dandelion *(Taraxacum officinale)*
	Foxtail (Green) *(Setaria viridis)*
	Common Groundsel *(Senecio vulgaris)*
	Buckhorn Plantain *(Plantago lanceolata)*
	Sweetclover, White *(Melilotus alba)*
	Foxtail (Yellow) *(Setaria lutescens)*
	Fine turf species
	Kentucky bluegrass *(Poa pratensis)*
	Perennial ryegrass *(Lolium perenne)*

Containers were kept moist until germination began, and thereafter were irrigated to prevent stress. Germination and establishment was assessed by counting seedling plants. Once target plants had matured sufficiently (5 weeks) the post-emergent herbicides were applied. The Weed Zap product was applied full strength as per label instructions. EcoSafe was diluted 1:20 in water and applied. Par III herbicide was applied at the label dilution for turf of 55 ml in 3 L of water. All herbicides were applied with a hand sprayer until the foliage was wet. Control containers were sprayed with distilled water. Plants were monitored for phytotoxicity and survival, and harvested after 6 weeks of recovery growth. The top growth and root systems were dried and dry weight recorded.

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

Results

Application of material was straightforward, although the Weed Zap product was slightly viscous and left significant white residue on the foliage of the target plants upon drying. The other two herbicides dried without visible residue. The EcoSafe product had a pronounced spicy odor which was quite strong (though not unpleasant).

Pre-application growth and harvest plant count. There were significant difference among

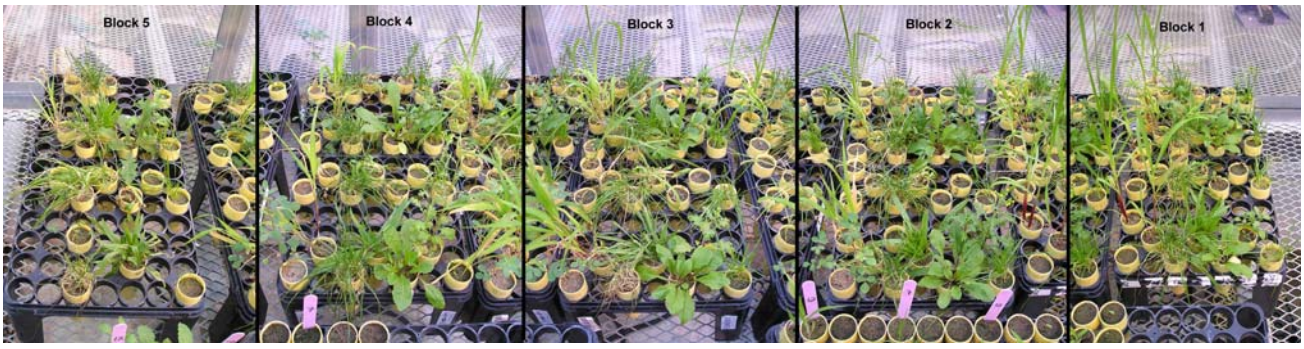


Figure 2. Layout of RCBD blocks, 18 days after treatment.

the species in germination and establishment (Table 2). Black medic did not germinate in sufficient numbers to be included in the experiment. Yellow foxtail and white sweetclover had small germination rates leading to reduced sample size and lack of significance in some of the observed patterns. Only in buckhorn plantain was there a treatment effect resulting in difference in survival of plants, with both Par III and Weed Zap significantly reducing the number of plants in the containers at harvest compared to the control and EcoSafe treatments. Harvest plant counts included all plants both living and dead, since the line between living and dead was not always easy to draw at this point. There was a general reduction in plant numbers in all containers between application date and harvest.

Phytotoxicity of herbicide treatments. There were significant treatment effects on leaf tissue necrosis in all species with the exception of yellow foxtail (Table 3, Figure 2). As mentioned above, the limited germination rate and small sample size for this species may have rendered the pattern non-significant – the trend in the pattern was similar to the other grass species. The four broadleaf weed species showed similar very strong patterns of post-emergent herbicide effect for both Par III and the Weed Zap product. In some cases (plantain, dandelion) the Weed Zap was significantly more effective, in others Par III and Weed Zap were equivalent. The EcoSafe product had no significantly different herbicide effect than the control. In the four grass species there was either a significant but very small herbicide effect of Par III and Weed Zap (Kentucky bluegrass, perennial ryegrass), or in the case of green foxtail a larger effect, particularly later in the experiment. As with the broadleaf weeds, the EcoSafe product provided no significant herbicide effect compared to the control treatment.

The of phytotoxic treatment effects as observed in dry matter accumulation was very similar to the leaf necrosis data (Table 4). The broadleaf weeds and green foxtail showed a sig-

Table 2. Effects of treatments on plant survival.

	Buckhorn Plantain	Groundsel	Dandelion	Sweetclover	Foxtail (green)	Foxtail (yellow)	Kentucky bluegrass	Perennial ryegrass
	Mean number of plants per container							
				3 days after treatment				
Control	>10	3.3[1]	3.5	3.0	5.0	1.5	4.4	>10
Ecosafe	>10	5.4	2.8	1.3	6.6	1.7	5.6	>10
Par III	>10	4.6	2.8	2.5	4.8	1.3	6.8	>10
Weed Zap	>10	3.0	2.0	2.8	6.0	1.0	5.2	>10
				40 days after treatment (harvest)				
Control	**6.6a**	2.0	3.0	1.7	3.8	1.5	3.8	15.6
Ecosafe	**6.8a**	4.0	2.8	1.0	6.4	1.7	3.8	18.4
Par III	**2.8b**	1.8	0.6	1.8	4.4	0.7	4.6	17.6
Weed Zap	**1.8b**	1.0	1.3	1.3	3.0	1.0	4.6	14.8

[1]Mean of 5 replicates; where a treatment effect was significant (bold) means within a column followed by the same letter are not significantly different (Duncans multiple range test, p=0.05)

Table 3. Phytotoxic effects of treatments on percent living leaf tissue.

	Buckhorn Plantain	Groundsel	Dandelion	Sweetclover	Foxtail (green)	Foxtail (yellow)	Kentucky bluegrass	Perennial ryegrass
	Living leaf tissue rating[1]							
				3 days after treatment				
Control	**10.0a[2]**	**9.8a**	**10.0a**	**10.0a**	**10.0a**	10.0	**9.2a**	**9.0**
Ecosafe	**9.8a**	**10.0a**	**10.0a**	**10.0a**	**9.8a**	10.0	**10.0a**	**10.0a**
Par III	**6.4b**	**2.6b**	**4.0b**	**3.0b**	**8.0b**	7.0	**9.2a**	**9.8ab**
Weed Zap	**1.3c**	**1.8b**	**1.5c**	**3.8b**	**4.2c**	8.5	**7.2b**	**8.2c**
				11 days after treatment				
Control	**9.8a**	**10.0a**	**10.0a**	**10.0a**	**8.5a**	10.0	**9.4ab**	**8.0b**
Ecosafe	**10.0a**	**9.2a**	**9.8a**	**9.8a**	**7.8a**	9.3	**10.0a**	**9.2a**
Par III	**5.8b**	**0.4b**	**2.4b**	**1.8b**	**3.6b**	5.3	**8.8bc**	**8.2b**
Weed Zap	**0.2c**	**1.6b**	**1.0b**	**2.3b**	**0.0c**	8.5	**8.3c**	**8.0b**
				18 days after treatment				
Control	**9.8a**	**10.0a**	**9.5a**	7.3	**8.8a**	9.0	**9.8a**	7.6
Ecosafe	**9.8a**	**10.0a**	**9.9a**	9.0	**8.8a**	9.7	**9.7a**	8.3
Par III	**3.7b**	**0.0b**	**3.0b**	2.4	**2.6b**	6.0	**8.9b**	6.3
Weed Zap	**0.0c**	**1.9b**	**1.5b**	2.0	**0.0c**	8.5	**9.1b**	8.0
				25 days after treatment				
Control	0.0	2.3	**7.4a**	1.0	**7.3a**	8.0	7.3	1.4
Ecosafe	0.0	0.0	**5.1ab**	6.4	**6.3a**	7.7	6.1	1.2
Par III	1.4	0.0	**0.0c**	0.0	**1.0b**	5.0	5.4	1.5
Weed Zap	0.6	0.0	**2.1bc**	2.1	**0.0b**	7.8	7.1	1.0

[1]Living leaf tissue rated visually on a scale from 0 (completely dead) – 10 (no dead leaf tissue).
[2]Mean of 5 replicates; where a treatment effect was significant (bold) means within a column followed by the same letter are not significantly different (Duncans multiple range test, p=0.05)

Table 4. Phytotoxic effects of treatments on root and shoot dry matter accumulation.

	Buckhorn Plantain	Groundsel	Dandelion	Sweetclover	Foxtail (green)	Foxtail (yellow)	Kentucky bluegrass	Perennial ryegrass
	Dry matter accumulation at harvest (40 DAT)							
				Root system (g dry weight)				
Control	**0.55a[1]**	**0.11b**	**0.61a**	0.32	**0.26a**	0.19	0.33	**1.06ab**
Ecosafe	**0.52a**	**0.26a**	**0.40b**	0.04	**0.16ab**	0.83	0.72	**0.84ab**
Par III	**0.13b**	**0.00c**	**0.00c**	0.00	**0.04c**	0.38	0.77	**1.57a**
Weed Zap	**0.03b**	**0.03bc**	**0.06c**	0.06	**0.08bc**	0.35	0.31	**0.43b**
				Shoot system (g dry weight)				
Control	**0.41a**	**0.20ab**	**0.26a**	0.11	**0.54a**	0.59	0.09	0.43
Ecosafe	**0.40a**	**0.25a**	**0.30a**	0.08	**0.41a**	0.62	0.27	0.56
Par III	**0.19b**	**0.02c**	**0.01b**	0.03	**0.17b**	0.41	0.13	0.51
Weed Zap	**0.13b**	**0.11bc**	**0.08b**	0.05	**0.19b**	0.20	0.19	0.56

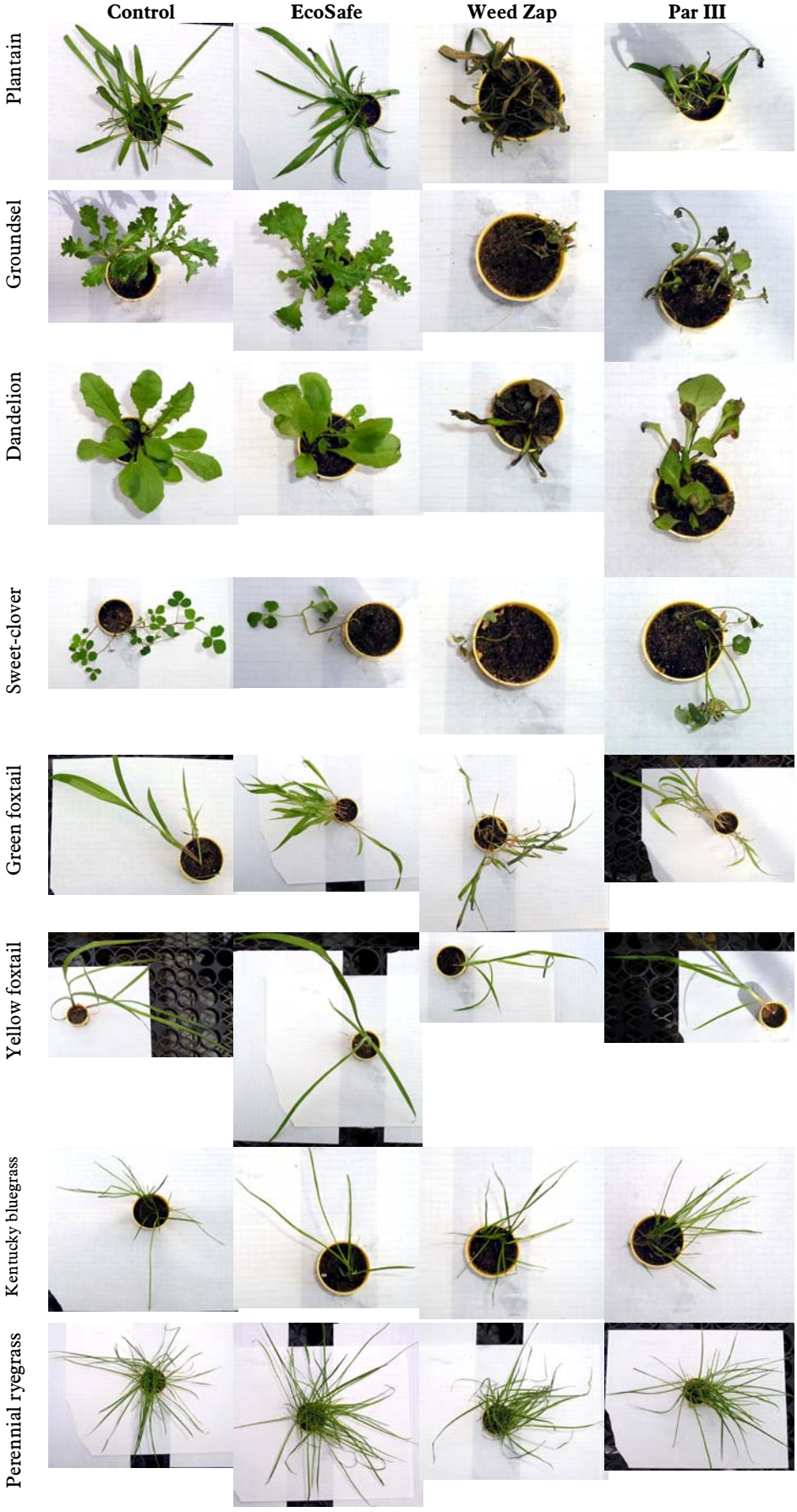
[1]Dry matter accumulation in grams; mean of 5 replicates. Where a treatment effect was significant (bold) means within a column followed by the same letter are not significantly different (Duncans multiple range test, p=0.05)

nificant herbicide effect for Par III and Weed Zap, but not for the EcoSafe or control treatments. There was little treatment effect on either fine turf species (Kentucky bluegrass and perennial ryegrass) or on yellow foxtail.

Conclusions

The Weed Zap experimental material had a significant post-emergent herbicidal effect on both broadleaf and grass species, both for leaf tis-

Figure 2. Typical effects of treatments on target plants 3 days after treatment (04/03/15).



sue necrosis and for growth rate inhibition in roots and shoots. Because the effect was weaker particularly in the two fine turfgrass species (Kentucky bluegrass and perennial ryegrass), there may be potential for the material to be used as a selective post-emergent herbicide in turf. The heavy white residual coating left by this material, which is presumably connected with its mode of action, may not be acceptable in a home lawn use. It is also rather viscous in application. This material had as good or better herbicidal properties as the Par III mecoprop/2,4-D/dicamba treatment.

The EcoSafe material generally did not produce any herbicidal effect different from the water control.