**Research Services Division**

# Project Report

## 1.0 Project Title:

Herbicidal activity of NEU1173H applied to turfgrass infested with creeping charlie (*Glechoma hederacea*) – Spring 2011 trial

## 2.0 Sponsor:

Neudorff

## 3.0 Objective:

To evaluate the efficacy of NEU1173H for control of creeping charlie (*Glechoma hederacea*) in established turfgrass.

## 4.0 Experimental Design / Methods:

Plots were located in an infested home lawn in Guelph, ON. The site is established turf predominantly Kentucky bluegrass; some perennial ryegrass and fine fescue. Turf was maintained with typical medium maintenance turf regime: 1.0 kg actual N 100 $m^{-2}$ per year in 1 application (spring); P and K in a 4:1:4 ratio with N; irrigated to prevent stress prior to treatment application and no irrigation 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 5 treatments (see Table 1). Each treatment was replicated six times in 1 x 1 m plots arranged in a randomized complete block design. Because of patchiness of weed presence, a 6 x 8 m area was mapped in 1 x 1 m plots and the 36 plots with the highest visual weed rating were used for the RCB design (Figure 1). Treatments were applied on June 18, 2011, and reapplied 4 weeks later on July 17. Treatments were applied with a battery powered backpack sprayer.

Turf was be mowed 3 days prior to treatment. Turf was well watered prior to application. Reapplication will be done as necessary and in consultation with the sponsor.

An anecdotal photographic record of the experiment was kept.

**Research Services Division**
328 Victoria Road South
Guelph, Ontario Canada N1L 0H2
Telephone (519) 767-5009
Fax (519) 766-1704
http://guelphturfgrass.ca
info@guelphturfgrass.ca

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

Figure 1. Plot area on June 18, 2011. Forty-eight 1x1 m plots were laid out, and the 36 plots with the heaviest infestation of creeping charlie were included in the experimental design.

Table 1. Treatments

| Treatment | Dilution Rate | Application rate (ml $m^{-2}$) |
|---|---|---|
| 1 Control | — | — |
| 2 NEU1173H (0.25 g a.i. $m^{-2}$) | NEU 1173H:water 24:1 | 100 |
| 3 NEU1173H (0.5 g a.i. $m^{-2}$) | NEU 1173H:water 24:1 | 200 |
| 4 NEU1173H (1 g a.i. $m^{-2}$) | NEU 1173H:water 24:1 | 400 |
| 5 Par III (0.55 ml $m^{-2}$) | | 100 |

**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.

## 5.0 Results:

*Phytotoxicity – visual ratings.* There was some phytotoxicity on the turfgrass as assessed by visual ratings in treated plots 7 DAT (Table 2). There phytotoxic effects on weeds at this point were much stronger. The phytotoxic effect on grasses was reduced at 2 weeks after the treatment, but by the time the reapplication, July 17 the turf was suffering from drought and heat stress and beginning to decline in all plots, including the control. By four weeks after the reapplication, there was significant grass loss in all plots, including the control, and no significant differences among the treatments. The grass loss does not appear to be a treatment effect, as evidenced by loss in the control plots and outside the treated areas (Figure 2).

*Phytotoxicity – canopy reflectance.* Canopy reflectance, which can be correlated with photosynthetic activity and plant health, showed a similar pattern to the visual phytotoxicity ratings (Table 3). There was a rate effect apparent in the experimental treatments, with higher rates producing a larger decline. Since the canopy reflectance readings integrate reflectance from both grass and weed foliage in the plots and there was a loss of grass in the plots generally, it is likely that much of the decline in NDVI values was due to phytotoxicity of the treatments to the weeds present.

Table 2. Visual ratings of phytotoxicity of treatments

| Treatment | Weed phytotoxicity | Grass phytotoxicity/death | | | |
|---|---|---|---|---|---|
| | 7 DAT | 7 DAT | 15 DAT | 29 DAT | 57 DAT |
| Fiesta 100 | 5.17 ab[1] | 1.33 b | 0.83 ab | 4.17 ab | 8.15 |
| Fiesta 200 | 4.83 b | 1.67 ab | 1.00 a | 4.33 ab | 7.33 |
| Fiesta 400 | 6.33 a | 2.33 a | 1.33 a | 6.17 b | 9.17 |
| Par III | 4.50 b | 0.00 c | 0.00 b | 3.00 a | 7.98 |
| Control | 0.00 c | 0.00 c | 0.00 b | 1.83 a | 6.33 |
| msd p=0.05 | 1.32 | 0.86 | 0.97 | 2.88 | NS |

[1] Visual ratings 0-10, 0 = no toxicity. Means of 6 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

Figure 2. Turf loss in untreated areas outside the treated plots (yellow outline). Some of the decline of turf in treated plots was presumed to be due to these stresses.

Table 3. Canopy reflectance of treated plots.

| Treatment | 2 DAT | 7 DAT | 15 DAT | 49 DAT |
|---|---|---|---|---|
| Fiesta 100 | 0.432[1] | 0.454 b | 0.471 bc | 0.195 bc |
| Fiesta 200 | 0.490 | 0.436 b | 0.404 cd | 0.092 c |
| Fiesta 400 | 0.468 | 0.392 b | 0.338 d | 0.062 c |
| Par III | 0.585 | 0.565 a | 0.502 b | 0.370 ab |
| Control | 0.572 | 0.633 a | 0.617 a | 0.459 a |
| msd p=0.05 | NS | 0.071 | 0.089 | 0.229 |

[1] Normalized-difference vegetation index; means of 6 replicates. Means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

*Weed infestation and control – visual ratings.* There was fairly heavy and uniform broadleaf weed infestation in the plots pre-treatment (Table 4, Figure 3). The average visual rating was about 5.3, which corresponds to about 30% cover as estimated by point-quadrat measurements. The weed pressure was mostly creeping charlie, with a smaller amount of violet (*Viola papilionacea*) and occasional dandelion (*Taraxacum officinale*), wood sorrel (*Oxalis dellenii*), chickweed (*Stellaria media*) and buttercup (*Ranunculus repens*).

Table 4. Visual ratings of weed presence.

| Treatment | -2 DAT | 7 DAT | 15 DAT | 29 DAT | 49 DAT | 57 DAT |
|---|---|---|---|---|---|---|
| | Weed rating | | | | | |
| Fiesta 100 | 5.83[1] | 2.67 b | 3.00 a | 4.00 b | 0.85 b | 0.57 b |
| Fiesta 200 | 5.17 | 1.67 b | 1.35 c | 2.35 bc | 0.02 b | 0.03 b |
| Fiesta 400 | 5.67 | 2.00 b | 0.22 c | 0.55 c | 0.33 b | 0.20 b |
| Par III | 4.83 | 3.83 ab | 1.50 c | 0.88 c | 1.83 ab | 2.33 ab |
| Control | 5.17 | 5.83 a | 4.83 a | 6.17 a | 4.17 a | 4.18 a |
| msd p=0.05 | NS | 2.31 | 2.54 | 2.15 | 2.79 | 2.74 |

[1] Visual rating 0-10, 0 = no weed, 10 = complete weed cover. Means of 6 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

There was significant control of total weeds assessed visually (basically creeping charlie) by all treatments, with the best reduction to about $<1\%$ of the levels in the untreated plots (Fiesta 200, 57 DAT). Control was faster to develop in the Par III standard, but weed levels had begun to rebound by 57 DAT; the Fiesta treatments, in contrast, still had significantly reduced weed levels at this point. There was a trend for differences among rates in the Fiesta treatments, though this was not statistically significant: the Fiesta 200 treatment had slightly less weed than either the Fiesta 100 or Fiesta 400. There was not complete control of the weeds with any treatment, even the standard (Par III). Regrowth will be assessed again in the spring of 2011.

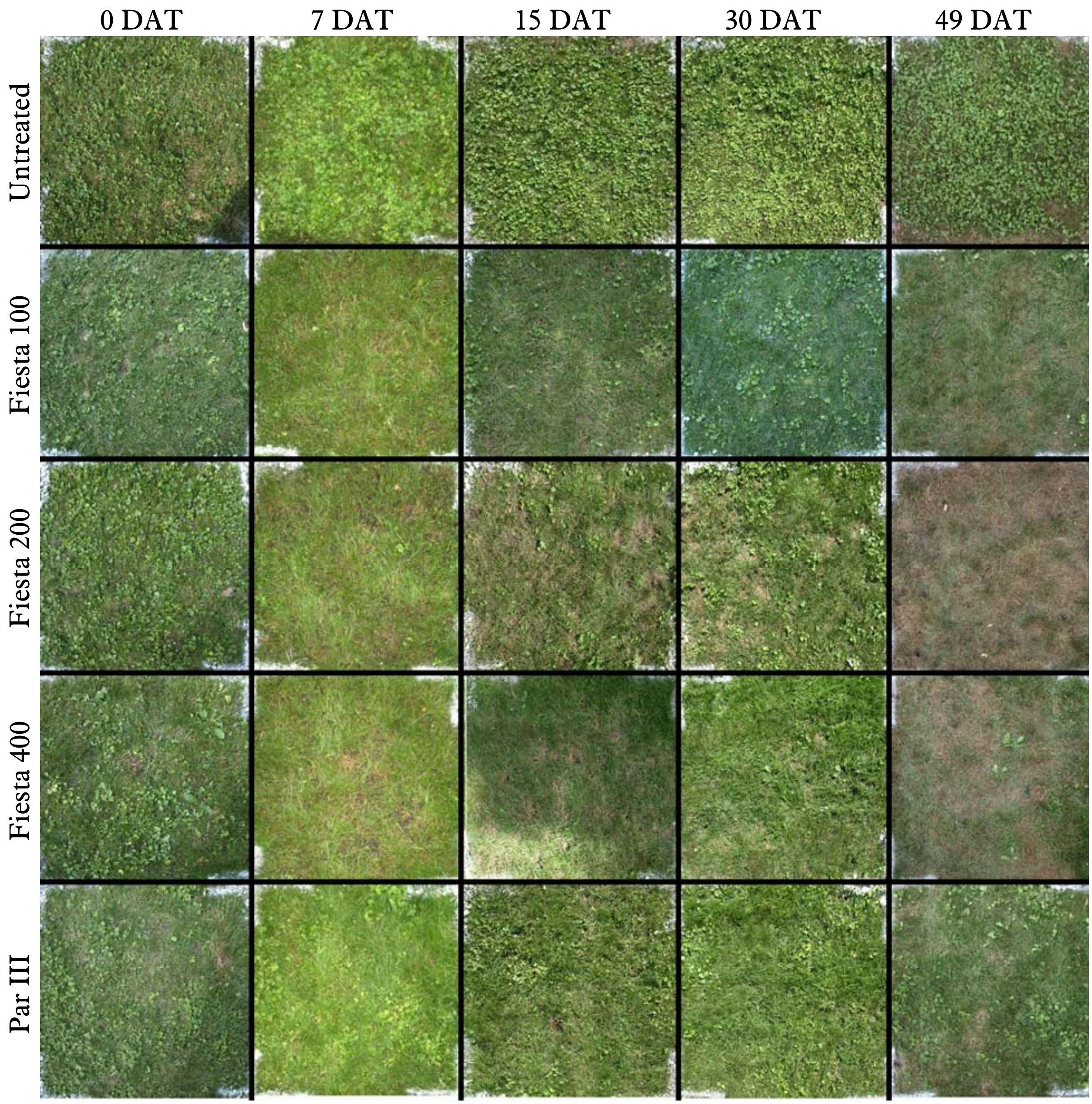


Figure 3. Representative plots at various times after first application (June 18). The second application date was 29 DAT (July 17). Images have been de-skewed and squared, but no color correction has been applied. The same plot is pictured in each row. Most of the visible weed is creeping charlie, with occasional dandelions.

*Weed infestation and control – point-quadrat measurements.* The data from the point-quadrat evaluations of weed were similar to the visual rating data, but showed some regrowth of weeds in the lowest rate Fiesta treatment, as well as in the Par II treatment. Six different weed species were found in the point-quadrats, the most common species being creeping charlie (*Glechoma hederacea*). None of the less common species were frequent enough to provide information on species-specific control, but their counts were included in the total weed data. Table 5 shows the results for the individual weed species and the total weed presence. The overall weed presence was about 30% cover pre-treatment, and increased slightly in the untreated control plots throughout the trial. All treatments controlled creeping charlie compared to the untreated plots, with a reduction to about 38% of the control by the 200 ml rate of Fiesta, and to about 43% of the control by the 400 ml rate of Fiesta.

Table 5. Percent area covered by total weeds, and individual weed species, estimated by point-quadrat counts.

| Treatment | Creeping charlie | Violet | Dandelion | Buttercup | Chickweed | Oxalis | Total weed |
|---|---|---|---|---|---|---|---|
| | | | | 0 DAT | | | |
| Fiesta 100 | 28.33[1] | 1.83 | 0.50 | 0.17 | 0.00 | 0.00 | 30.83 |
| Fiesta 200 | 26.67 | 2.33 | 0.67 | 0.00 | 0.33 | 0.00 | 30.00 |
| Fiesta 400 | 26.83 | 2.17 | 1.67 | 0.00 | 0.00 | 0.00 | 30.67 |
| Par III | 23.17 | 2.67 | 0.67 | 0.00 | 0.00 | 0.17 | 26.67 |
| Control | 22.83 | 3.50 | 1.67 | 0.00 | 0.00 | 0.17 | 28.17 |
| msd p=0.05 | NS | NS | NS | NS | NS | NS | NS |
| | | | | 120 DAT | | | |
| Fiesta 100 | 33.17 a | 0.00 b | 2.17 | 0.00 | 0.00 | 0.33 | 35.67 a |
| Fiesta 200 | 11.33 b | 0.17 b | 2.00 | 0.00 | 0.00 | 0.33 | 13.83 b |
| Fiesta 400 | 13.00 b | 0.00 b | 2.67 | 0.00 | 0.00 | 0.83 | 17.00 b |
| Par III | 31.83 a | 4.67 a | 0.33 | 0.00 | 0.00 | 0.67 | 37.50 a |
| Control | 30.00 a | 1.83 ab | 1.83 | 0.00 | 0.00 | 0.00 | 33.67 a |
| msd p=0.05 | 15.35 | 2.96 | NS | NS | NS | NS | 14.64 |

[1]Point-quadrat count of 100 points x 6 replicates. Means of 6 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD, p=0.05).

## 6.0 Conclusions:

All of the treatments gave effective control of creeping charlie at 8 weeks after appliecation, with a single reapplication at 4 weeks. The experimental herbicide treatments gave levels of control better than the standard treatment (Par III). For the experimental treatments, there was an initial immediate phytotoxic effect within one or two days, whereas the Par III took a week to 10 days to begin to reduce weed presence. There was some evidence of regrowth in weed by 16 weeks after treatment, but this may be related to the fact that there was significant loss of turf in the treatment area due to drought stress and other undetermined stresses.