

Efficacy of experimental herbicide products

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MATERIALS/METHODS

Plots were located in turf research area at the Guelph Turfgrass Institute, Guelph, ON. The site is an area of established turf (predominantly turf-type perennial ryegrass, infested with dandelion, clover and other lawn weeds) (Figure 1). Turf was maintained with typical medium maintenance turf regime: 1.0 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 14 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 on June 7, 2010. Treatments were applied

with a compressed air sprayer (Teejet 8001VS flat fan nozzles - 5 ml/sec/nozzle at 20 psi).

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 treatment and later in the season. 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.

Table 1. Treatments

| Treatment | Dilution rate | App. Rate (gal/acre) |
|---|---------------|----------------------|
| 1 SC Conc | 0.2 | 200 |
| 2 SC1 | ReadyToUse | 200 |
| 3 SC1 | RTU | 400 |
| 4 SC2 | RTU | 200 |
| 5 SC2 | RTU | 400 |
| 6 SC2 (watered in with 10 mm water) | RTU | 200 |
| 7 VNT-1 | RTU | 200 |
| 8 VNT-1 (watered in with 10 mm water) | RTU | 200 |
| 9 VNT-2 | RTU | 200 |
| 10 VNT-2 (2 nd application 15 days after 1 st) | RTU | 200 |
| 11 VNT-3 | RTU | 400 |
| 12 VNT-4 | RTU | 200 |
| 13 Ecosense Pathclear, 6.25% acetic acid | RTU | 200 |
| 14 Control | | |



Figure 1. Plot area, pretreatment (April 30, 2010).

RESULTS

Phytotoxicity immediately post-treatment.

There was evidence on broadleaf weeds and grasses of leaf tissue death within a day of treatment, visible in visual ratings 8 DAT (Table 2). The Ecosense, SC2 treatments and VNT-3 treatments had significantly higher damage than

the other treatments and control. The visible phytotoxic effects had mostly disappeared by 23 DAT, except for the VNT-2 treatment which had been repeated 15 days after the first application.

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

Table 2. Visual ratings of phytotoxicity and weed presence

| Treatment | Phytotoxicity | | Weed | | | |
|-----------------|--------------------|--------|---------|---------|--------|--------|
| | 8 DAT | 23 DAT | 8 DAT | 23 DAT | 42 DAT | 52 DAT |
| Control | 0.3 ¹ c | 0.0 b | 4.5 a | 5.0 a | 5.3 ab | 5.8 |
| Ecosense | 6.0 a | 0.0 b | 2.8 abc | 5.0 a | 6.0 a | 6.5 |
| SC conc | 5.5 ab | 0.0 b | 1.3 c | 3.3 abc | 3.8 ab | 4.8 |
| SC1-200 | 1.0 c | 0.0 b | 3.5 ab | 5.0 a | 4.5 ab | 6.0 |
| SC1-400 | 2.5 c | 0.0 b | 2.5 abc | 4.0 abc | 4.5 ab | 5.5 |
| SC2-200 | 5.5 a | 0.0 b | 2.0 bc | 3.5 abc | 4.8 ab | 5.5 |
| SC2-200 water | 2.5 c | 0.0 b | 2.3 bc | 3.5 abc | 4.0 ab | 4.8 |
| SC2-400 | 7.0 a | 0.0 b | 1.8 bc | 4.8 a | 5.5 ab | 6.0 |
| VNT-1-200 | 3.0 bc | 0.0 b | 3.3 abc | 4.3 a | 5.0 ab | 5.8 |
| VNT-1-200 water | 0.8 c | 0.0 b | 3.3 abc | 4.3 a | 4.5 ab | 5.3 |
| VNT-2-200 | 1.3 c | 0.0 b | 2.8 abc | 3.3 abc | 4.3 ab | 5.3 |
| VNT-2-200 2x | 1.3 c | 1.0 a | 3.0 abc | 1.5 c | 3.0 b | 4.3 |
| VNT-3-400 | 6.5 a | 0.0 b | 1.8 bc | 4.0 ab | 4.5 ab | 5.5 |
| VNT-4-200 | 2.0 c | 0.0 b | 2.0 bc | 2.0 bc | 3.8 ab | 5.8 |
| msd p=0.05 | 2.9 | 0.0 | 2.1 | 2.1 | 2.7 | NS |

¹ Visual ratings 0-10, 10 = most phytotoxicity, 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).

by all treatments relative to the control (Table 3, Figure 2). Differences among treatments were statistically significant on all dates, but the patterns varied. At the peak damage, 4 DAT, the

most affected treatments, SC2-400, VNT-3-400, Ecosense, SC conc, and SC2-200, had almost no canopy reflectance left (Figure 3). Regrowth of the canopy, both grasses and weeds, had restored

Table 3. Canopy reflectance in treated plots.

| Treatment | -21 DAT | -11 | -6 | -5 | -3 | 1 | 3 | 4 | 7 |
|-----------------|--------------------|-------|-------|-------|-------|-------|-------|----------|-------|
| Control | 0.585 ¹ | 0.679 | 0.664 | 0.747 | 0.683 | 0.647 | 0.680 | 0.575 a | 0.588 |
| Ecosense | 0.585 | 0.666 | 0.657 | 0.773 | 0.689 | 0.346 | 0.320 | 0.105 j | 0.207 |
| SC conc | 0.591 | 0.677 | 0.653 | 0.782 | 0.701 | 0.337 | 0.388 | 0.134 i | 0.276 |
| SC1-200 | 0.582 | 0.663 | 0.649 | 0.711 | 0.682 | 0.616 | 0.658 | 0.528 cd | 0.516 |
| SC1-400 | 0.612 | 0.659 | 0.651 | 0.767 | 0.697 | 0.576 | 0.609 | 0.452 f | 0.466 |
| SC2-200 | 0.601 | 0.678 | 0.669 | 0.743 | 0.688 | 0.378 | 0.409 | 0.163 h | 0.255 |
| SC2-200 water | 0.603 | 0.675 | 0.661 | 0.781 | 0.682 | 0.518 | 0.550 | 0.382 g | 0.444 |
| SC2-400 | 0.568 | 0.688 | 0.658 | 0.714 | 0.681 | 0.300 | 0.221 | 0.037 k | 0.157 |
| VNT-1-200 | 0.611 | 0.666 | 0.666 | 0.745 | 0.701 | 0.607 | 0.639 | 0.477 e | 0.490 |
| VNT-1-200 water | 0.597 | 0.673 | 0.640 | 0.830 | 0.702 | 0.656 | 0.691 | 0.575 a | 0.556 |
| VNT-2-200 | 0.601 | 0.681 | 0.678 | 0.748 | 0.690 | 0.642 | 0.662 | 0.536 bc | 0.527 |
| VNT-2-200 2x | 0.585 | 0.663 | 0.652 | 0.805 | 0.681 | 0.641 | 0.670 | 0.554 ab | 0.525 |
| VNT-3-400 | 0.581 | 0.666 | 0.644 | 0.751 | 0.681 | 0.314 | 0.315 | 0.082 j | 0.198 |
| VNT-4-200 | 0.577 | 0.674 | 0.647 | 0.802 | 0.701 | 0.621 | 0.648 | 0.508 d | 0.499 |
| msd p=0.05 | 0.020 | 0.026 | 0.012 | 0.016 | 0.008 | 0.015 | 0.014 | 0.025 | 0.023 |
| | 9 | 21 | 35 | 38 | 42 | 46 | 57 | 63 | 73 |
| Control | 0.612 | 0.611 | 0.658 | 0.621 | 0.608 | 0.646 | 0.598 | 0.603 | 0.578 |
| Ecosense | 0.251 | 0.556 | 0.651 | 0.642 | 0.627 | 0.687 | 0.601 | 0.584 | 0.515 |
| SC conc | 0.290 | 0.545 | 0.647 | 0.643 | 0.624 | 0.674 | 0.587 | 0.583 | 0.539 |
| SC1-200 | 0.540 | 0.597 | 0.653 | 0.627 | 0.602 | 0.643 | 0.578 | 0.592 | 0.540 |
| SC1-400 | 0.486 | 0.588 | 0.654 | 0.626 | 0.620 | 0.656 | 0.567 | 0.587 | 0.526 |
| SC2-200 | 0.313 | 0.534 | 0.631 | 0.622 | 0.615 | 0.681 | 0.591 | 0.568 | 0.517 |
| SC2-200 water | 0.457 | 0.587 | 0.647 | 0.631 | 0.605 | 0.658 | 0.573 | 0.569 | 0.560 |
| SC2-400 | 0.188 | 0.504 | 0.630 | 0.632 | 0.621 | 0.670 | 0.583 | 0.563 | 0.508 |
| VNT-1-200 | 0.519 | 0.591 | 0.665 | 0.638 | 0.624 | 0.681 | 0.618 | 0.600 | 0.554 |
| VNT-1-200 water | 0.573 | 0.608 | 0.650 | 0.619 | 0.594 | 0.653 | 0.576 | 0.577 | 0.533 |
| VNT-2-200 | 0.539 | 0.574 | 0.648 | 0.639 | 0.616 | 0.663 | 0.600 | 0.543 | 0.505 |
| VNT-2-200 2x | 0.531 | 0.508 | 0.609 | 0.605 | 0.608 | 0.645 | 0.556 | 0.553 | 0.499 |
| VNT-3-400 | 0.249 | 0.535 | 0.647 | 0.632 | 0.627 | 0.664 | 0.545 | 0.567 | 0.524 |
| VNT-4-200 | 0.521 | 0.565 | 0.638 | 0.615 | 0.608 | 0.657 | 0.567 | 0.569 | 0.515 |
| msd p=0.05 | 0.022 | 0.014 | 0.011 | 0.014 | 0.011 | 0.013 | 0.016 | 0.018 | 0.025 |

¹Normalized-difference vegetation index. Means of ~50 readings x 4 replicates. Means comparisons by Tukey's HSD test (p=0.05). Means comparison groupings are shown by letters at the peak of treatment phytotoxicity, 4 DAT.



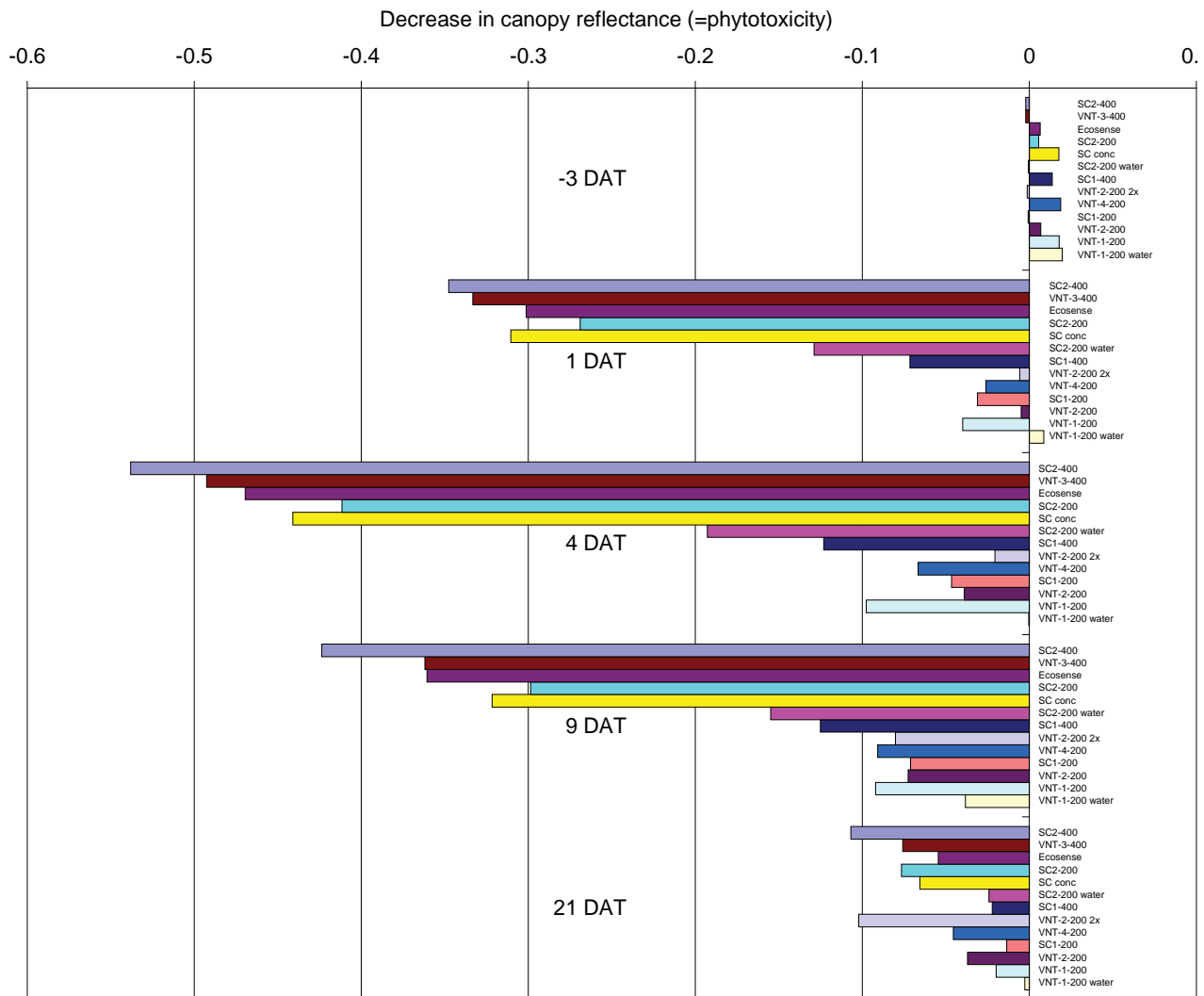


Figure 2. Reduction in canopy reflectance (normalized-difference vegetation index) in treated plots during the peak period of phytotoxicity, first 3 weeks after treatment.

the NDVI values to near the control plots by 35 DAT.

Broadleaf weed control. Broadleaf weed infestation in the plot area before treatment was about 27% of the area, as estimated by point-quadrat counts (Table 4). This is roughly equivalent to a visual rating of 3. Most of the weed present was dandelion and chickweed, with smaller amounts of black medic, field bindweed, white clover, narrowleaf plantain, and thistle. There was significant reduction in total broadleaf weed by 3 weeks after treatment in most treatments (from 27% to 14%), but by 9 weeks after treatment the weed presence had increased back to 30%, and significant differences with the control had disappeared. Treatments which

showed significant weed reduction at 3 weeks relative to the control plots were: VNT-4-200, VNT-2-200 2x, SC conc, VNT-2-200, and SC2-200 water.

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. Often the reductions were not significantly different than the control, and the broadleaf weeds regrew to untreated control levels in all treatments by 9 weeks after treatment. Treatments which showed significant weed reduction at 3 weeks relative to the control plots were: VNT-4-200, VNT-2-200 2x, SC conc, VNT-2-200, and SC2-200 water.

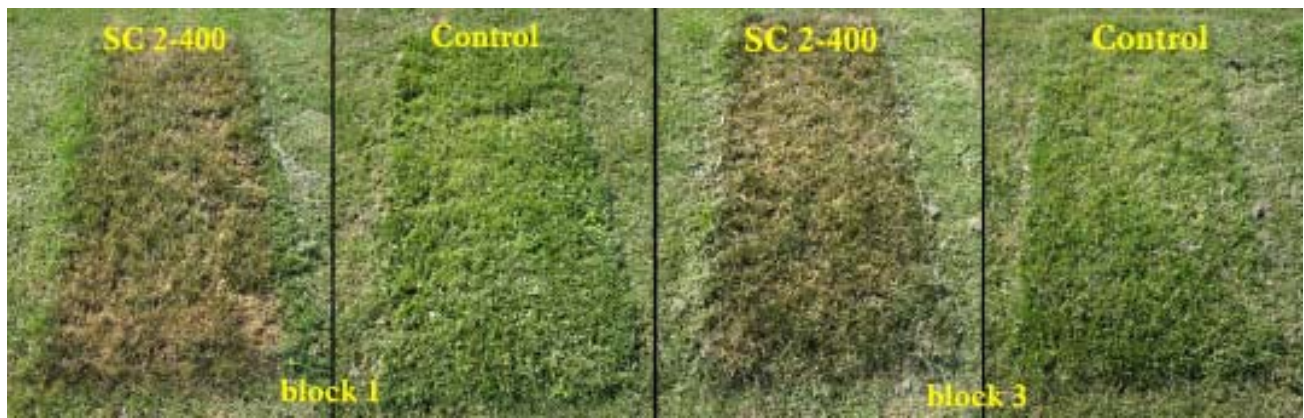


Figure 3. Typical phytotoxicity in the most and least affected treatments, 4 DAT.

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

| Treatment | Total weed | | | Dandelion | | | Black medick | | | Chickweed | | |
|-----------------|------------|-------------|-----------|---------------------|-------------|-------------|--------------|------------|-------------|------------|------------|------------|
| | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT |
| Control | 29.0 | 22.7 | 36.7 | 17.3 | 6.0 | 20.0 | 4.7 | 8.3 | 14.0 | 5.0 | 5.3 | 1.7 |
| Ecosense | 30.0 | 19.7 | 38.7 | 21.3 | 13.0 | 30.0 | 2.0 | 1.3 | 3.3 | 5.3 | 1.0 | 1.7 |
| SC conc | 27.7 | 10.0 | 23.7 | 18.0 | 4.3 | 18.7 | 1.3 | 0.3 | 0.7 | 4.3 | 1.0 | 1.0 |
| SC1-200 | 30.0 | 20.0 | 30.7 | 20.3 | 7.3 | 16.0 | 1.7 | 5.3 | 8.0 | 5.7 | 4.0 | 2.7 |
| SC1-400 | 27.0 | 16.0 | 33.7 | 12.7 | 6.0 | 21.0 | 6.0 | 2.3 | 5.3 | 6.7 | 3.7 | 3.3 |
| SC2-200 | 30.0 | 16.3 | 30.0 | 16.0 | 7.7 | 20.0 | 1.0 | 0.7 | 2.0 | 6.7 | 2.7 | 1.0 |
| SC2-200 water | 20.3 | 11.3 | 26.0 | 12.0 | 4.3 | 16.0 | 1.7 | 0.0 | 3.7 | 4.3 | 2.0 | 1.0 |
| SC2-400 | 34.3 | 15.3 | 31.3 | 23.7 | 11.7 | 27.3 | 3.7 | 0.0 | 0.3 | 4.7 | 0.7 | 0.7 |
| VNT-1-200 | 28.0 | 20.3 | 33.3 | 16.0 | 6.7 | 15.7 | 2.7 | 1.3 | 8.7 | 6.0 | 5.3 | 2.7 |
| VNT-1-200 water | 26.3 | 15.0 | 32.0 | 13.3 | 4.3 | 14.0 | 2.0 | 1.0 | 5.0 | 8.0 | 6.3 | 8.0 |
| VNT-2-200 | 28.3 | 11.0 | 27.7 | 15.0 | 3.7 | 17.0 | 1.7 | 2.0 | 3.3 | 8.3 | 1.7 | 2.0 |
| VNT-2-200 2x | 20.3 | 4.3 | 22.0 | 11.0 | 3.0 | 16.0 | 1.7 | 0.0 | 1.7 | 7.0 | 1.3 | 0.7 |
| VNT-3-400 | 28.3 | 13.3 | 32.3 | 20.7 | 9.7 | 27.0 | 2.3 | 0.0 | 0.7 | 3.0 | 0.0 | 0.3 |
| VNT-4-200 | 27.3 | 4.3 | 27.3 | 18.3 | 2.0 | 19.7 | 0.7 | 0.7 | 5.3 | 6.3 | 1.3 | 1.0 |
| msd p=0.05 | NS | 10.8 | NS | NS | 7.6 | 17.8 | NS | 3.0 | 7.8 | NS | 5.0 | 4.4 |
| Treatment | Bindweed | | | Narrowleaf plantain | | | Clover | | | Thistle | | |
| | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT | -20 DAT | 22 DAT | 60 DAT |
| Control | 1.0 | 2.0 | 0.7 | 0.0 | 1.0 | 0.3 | 0.7 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 |
| Ecosense | 0.7 | 4.0 | 3.0 | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 |
| SC conc | 2.7 | 3.7 | 3.0 | 1.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 |
| SC1-200 | 2.0 | 2.7 | 3.0 | 0.3 | 0.7 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SC1-400 | 1.7 | 4.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| SC2-200 | 2.0 | 2.3 | 2.0 | 4.3 | 2.7 | 3.7 | 0.0 | 0.3 | 1.0 | 0.0 | 0.0 | 0.3 |
| SC2-200 water | 1.0 | 3.3 | 3.3 | 1.0 | 1.7 | 1.3 | 0.3 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 |
| SC2-400 | 2.0 | 2.3 | 2.0 | 0.3 | 0.7 | 0.3 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 |
| VNT-1-200 | 0.7 | 4.0 | 5.7 | 2.7 | 2.7 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 0.0 |
| VNT-1-200 water | 2.3 | 3.3 | 4.3 | 0.7 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| VNT-2-200 | 0.7 | 0.7 | 2.7 | 2.7 | 2.7 | 2.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 |
| VNT-2-200 2x | 0.0 | 0.0 | 2.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 1.3 | 0.0 | 0.0 | 0.0 |
| VNT-3-400 | 1.0 | 3.7 | 3.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 1.3 | 0.0 | 0.0 |
| VNT-4-200 | 1.7 | 0.3 | 1.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 |
| msd p=0.05 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

¹Percent cover area estimated by point-quadrat weed counts: 100 points per plot x 4 replicates. Bolded columns are statistically significant means comparisons (Tukey's HSD, p=0.05).

All of the treatments were phytotoxic to both weeds and grass, with SC2 and VNT-3 being particularly phytotoxic. Both grass and weeds recovered from the phytotoxic effects by 5 weeks after treatment. Watering treatments in with 10 mm of water immediately after application reduced the phytotoxic effects in the two treatments where it was tested.

