

# REDUCING OR MASKING DISCOLORATION AND PHYTOTOXICITY FROM VELOCITY APPLIED TO GOLF COURSE PUTTING GREEN USING CIVITAS, 2010

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## INTRODUCTION

Velocity (bispyribac-sodium) is a promising new herbicide used for the post-emergent control of annual bluegrass (*Poa annua*) on golf course fairways. One of the negative aspects of this herbicide is the typical phytotoxicity or “yellow flash” that occurs when applied to creeping bentgrass. Although currently only labeled for creeping bentgrass (*Agrostis stolonifera*) or perennial ryegrass (*Lolium perenne*) fairways, there is increasing interest in utilizing Velocity on golf course putting greens. The negative aspects associated with the yellow flash, however, make its safety questioned on short-cut turf. Civitas, a horticultural oil based fungicide, is a relatively new product shown to have fungicidal properties by inducing systemic resistance within plants, thereby rendering the plant more resistant to select pests. Recommended applications of Civitas also include the tank-mixing of Harmonizer, a blue pigment which may provide enhanced turfgrass quality and color. The objective of this study was to evaluate the ability of Civitas + Harmonizer to reduce or mask any discoloration or phytotoxicity caused by repeated application of Velocity.

## MATERIALS & METHODS

This study was initiated at the Valentine Turfgrass Research Center located in University Park, PA. Soil was a sandy loam with a pH 7.1 and an OM of 1.77%. Turfgrass used for the herbicide evaluation was a mixed stand of predominantly ‘Penn A4’ creeping bentgrass with approximately 5 to 10% annual bluegrass. The area was maintained as a bentgrass green and mowed six times per week to a height of 0.125 in. All herbicide treatments were applied with a CO<sub>2</sub> pressurized (40 psi) sprayer equipped with an air-induction flat fan nozzle (AI9508E), and calibrated to deliver 2.0 gal water per 1000 ft<sup>2</sup>. Treatments were initially applied on 8 Jul and reapplied approximately on a 7-d interval for a total of 5 applications. All treatments and application dates are listed in the data tables.

Plots measured 3 ft x 6 ft and were arranged in a randomized complete block with four replications. Turfgrass quality and/or color were also visually rated on a 1 to 9 scale where 1 = entire plot brown or dead and 9 = optimum greenness and density. Percent dead bentgrass was rated on a 0 to 100% scale where 0 = entire plot green and healthy and 100 = entire plot area brown or dead. Turfgrass injury was rated on a scale of 0 to 5 where 0 = no injury visible, 2.0 = minimum acceptable injury for a golf course green, and 5.0 = entire plot area brown or dead. All data were subjected to analysis of variance and means were separated at  $P \leq 0.05$  according to Fisher’s Protected Least Significant Difference Test.

## RESULTS

*Injury and death.* Within one week of application, plots treated with the high rate of Velocity exhibited the greatest level of injury (Table 1). However, slight injury was also observed within the untreated control plots indicating discoloration that may be associated with existing environmental conditions rather than the herbicide. Regardless, plots treated with Velocity + Civitas generally resulted in less visible injury to the bentgrass although few significant differences occurred during the first week. When plots were rated on 27 Jul (4 days after the third application), unacceptable injury (>3.0) was observed within plots treated with all rates of Velocity alone and tank-mix combinations of each with Civitas resulted in a significant reduction in injury within the study site. On the final date in which injury was able to be rated (13 Aug; 1 or 2 weeks after the final application), however, all plots exhibited significant unacceptable injury regardless of treatment. At this time, no injury was observed within the untreated control plots. The injury observed on this rating date manifested itself as dead or dying creeping

bentgrass. Death to the creeping bentgrass caused by Velocity increased with increasing rates and 22%, 69%, and 89% dead turf within plots treated with 1.0, 2.0, and 4.0 oz of Velocity, respectively. When tank-mixed with Civitas, injury was equal or greater within plots treated with similar rates of Velocity only. On the final rating date (26 Aug; 3 to 4 weeks after the final application), the high rate of Velocity applied four times had between 84% and 98% dead creeping bentgrass and no differences were observed between plots treated with or without Civitas. On 26 Aug, plots treated five times with 2.0 oz of Velocity had 48% dead creeping bentgrass, whereas only 12% dead turf was observed within plots treated with 1.0 oz and these plots were not significantly different from the untreated control plots. In plots treated five times with either 1.0 or 2.0 oz of Velocity and tank-mixed with Civitas, however, creeping bentgrass death was significantly increased. At this time, a total of 33% and 91% dead creeping bentgrass was observed within plots treated with Civitas and either 1.0 or 2.0 oz of Velocity, respectively.

Quality and color. Quality and color ratings early in the study were highly influenced by the dark green color of the turf stand following applications in which Harmonizer was applied (Table 2). While the color increases were not significantly higher than the untreated control plots, Civitas + Harmonizer was able to improve the discoloration caused by the Velocity alone. As turfgrass injury and death developed throughout the plots, however, the positive impact of Civitas + Harmonizer was lost.

## DISCUSSION

The ability to mask the phytotoxic or yellow flash discoloration caused by Velocity on golf course putting greens may help to reduce potential negative aesthetics associated with its application. While repeated application of Velocity are necessary to suppress annual bluegrass to acceptable levels, weekly applications of  $\geq 2.0$  oz may prove too phytotoxic to desirable bentgrass species. While Civitas + Harmonizer was able to reduce the appearance of creeping bentgrass injury early during the application process, it was unable to reduce the ultimate death of the turf following repeated applications of Velocity. Interestingly, the combination of Civitas + Harmonizer appeared to increase or at least make the resulting injury from Velocity more visible when applied at either 1.0 or 2.0 oz.

This is the first study that we know of that tried to utilize Civitas to mask the potential negative phytotoxic effects of Velocity when applied to a creeping bentgrass putting green. While the fungicide was capable of reducing injury early in the application process, it ultimately did not make Velocity safer to use on creeping bentgrass. Future studies, however, should investigate the combination of lower use rates of Velocity on longer application intervals in combination with properly timed Civitas applications. The increased death observed when Civitas was used in combination with the lower Velocity rates (1.0 and 2.0 oz) may have been due to the more visible blue color on dead, rather than living turf. Discoloration and death of the area remained for several months after the completion of the study and recover was not observed prior to the winter months. Future studies may also seek to determine the impact of both Velocity and Civitas on creeping bentgrass germination and survival following overseeding of areas previously treated with each product.

Table 1. Creeping bentgrass injury and death on a putting green following treatment with Velocity or Velocity and Civitas, 2010.

| Treatment and rate per 1000 sq ft | Application Code <sup>x</sup> | Injury <sup>z</sup> |        |        | % dead <sup>y</sup> |        |
|-----------------------------------|-------------------------------|---------------------|--------|--------|---------------------|--------|
|                                   |                               | 13 Jul              | 27 Jul | 13 Aug | 13 Aug              | 26 Aug |
| 1 Velocity 17.6SG 4.0 oz .....    | ABCD                          | 2.0 a <sup>w</sup>  | 4.0 a  | 4.8 a  | 88.5 a              | 83.5 a |
| 2 Velocity 17.6SG 4.0 oz          | ABCD                          |                     |        |        |                     |        |
| Civitas 16 fl oz                  | ABCD                          |                     |        |        |                     |        |
| Harmonizer 1.0 fl oz .....        | ABCD                          | 0.8 ab              | 1.8 bc | 5.0 a  | 97.0 a              | 98.0 a |
| 3 Velocity 17.6SG 2.0 oz .....    | ABCDE                         | 1.8 ab              | 4.0 a  | 3.8 b  | 68.5 b              | 48.0 b |
| 4 Velocity 17.6SG 2.0 oz          | ABCDE                         |                     |        |        |                     |        |
| Civitas 16 fl oz                  | ABCDE                         |                     |        |        |                     |        |
| Harmonizer 1.0 fl oz .....        | ABCDE                         | 0.3 b               | 2.3 b  | 4.8 a  | 83.0 a              | 91.0 a |
| 5 Velocity 17.6SG 1.0 oz .....    | ABCDE                         | 1.5 ab              | 3.3 a  | 3.3 b  | 21.5 c              | 11.5 c |
| 6 Velocity 17.6SG 1.0 oz          | ABCDE                         |                     |        |        |                     |        |
| Civitas 16 fl oz                  | ABCDE                         |                     |        |        |                     |        |
| Harmonizer 1.0 fl oz .....        | ABCDE                         | 0.3 b               | 0.8 d  | 3.3 b  | 27.0 c              | 33.0 b |
| 7 Untreated .....                 |                               | 1.3 ab              | 1.0 cd | 0.0 c  | 0.0 d               | 0.0 c  |

<sup>z</sup> Creeping bentgrass injury was rated on a 0 to 5 scale where 0 = no injury,  $\geq 3$  = unacceptable injury for a golf course putting green, and 5 = entire plot brown or dead.

<sup>y</sup> Percent of plot area dead was assessed visually on a linear 0 to 100% scale where 0 = entire plot area green and healthy, and 100 = entire plot brown or dead.

<sup>x</sup> Treatments were applied as follows: A = 8 Jul; B = 15 Jul; C = 23 Jul; D = 30 Jul; and E = 6 Aug.

<sup>w</sup> Means in a column followed by the same letter are not significantly different at  $P \leq 0.05$  level according to the Fisher's protected least significant difference t-test.

Table 2. Overall turfgrass quality and color of creeping bentgrass on a putting green following treatment with Velocity or Velocity and Civitas, 2010.

| Treatment and rate per 1000 sq ft | Application Code <sup>x</sup> | Quality <sup>z</sup> |         | Color <sup>y</sup> |        |
|-----------------------------------|-------------------------------|----------------------|---------|--------------------|--------|
|                                   |                               | 27 Jul               | 13 Aug  | 13 Jul             | 27 Jul |
| 1 Velocity 17.6SG 4.0 oz .....    | ABCD                          | 2.5 e <sup>w</sup>   | 1.8 d   | 4.8 d <sup>x</sup> | 2.3 d  |
| 2 Velocity 17.6SG 4.0 oz          | ABCD                          |                      |         |                    |        |
| Civitas 16 fl oz                  | ABCD                          |                      |         |                    |        |
| Harmonizer 1.0 fl oz .....        | ABCD                          | 7.5 ab               | 2.8 cd  | 7.5 ab             | 7.5 a  |
| 3 Velocity 17.6SG 2.0 oz .....    | ABCDE                         | 3.5 d                | 3.0 bcd | 5.3 cd             | 3.3 cd |
| 4 Velocity 17.6SG 2.0 oz          | ABCDE                         |                      |         |                    |        |
| Civitas 16 fl oz                  | ABCDE                         |                      |         |                    |        |
| Harmonizer 1.0 fl oz .....        | ABCDE                         | 6.8 b                | 3.0 bcd | 8.3 a              | 6.0 b  |
| 5 Velocity 17.6SG 1.0 oz .....    | ABCDE                         | 4.5 c                | 4.0 bc  | 6.5 bc             | 3.8 c  |
| 6 Velocity 17.6SG 1.0 oz          | ABCDE                         |                      |         |                    |        |
| Civitas 16 fl oz                  | ABCDE                         |                      |         |                    |        |
| Harmonizer 1.0 fl oz .....        | ABCDE                         | 7.5 ab               | 4.3 b   | 8.5 a              | 7.0 ab |
| 7 Untreated .....                 |                               | 7.8 a                | 7.5 a   | 8.0 a              | 7.5 a  |

<sup>z</sup> Turfgrass quality was rated visually on a 1 to 9 scale where 1 = brown or dead turf; 7.0 = minimum acceptable quality for a golf course fairway; and 9 = optimum density.

<sup>y</sup> Turfgrass color was rated visually on a 1 to 9 scale where 1 = brown or dead turf; 7.0 = minimum acceptable color for a golf course fairway; and 9 dark green turf.

<sup>x</sup> Treatments were applied as follows: A = 8 Jul; B = 15 Jul; C = 23 Jul; D = 30 Jul; and E = 6 Aug.

<sup>w</sup> Means in a column followed by the same letter are not significantly different at  $P \leq 0.05$  level according to the Fisher's protected least significant difference t-test.