

Fungicide Application and Winter Injury on Creeping Bentgrass

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During winter conditions some fungal diseases prosper on creeping bentgrass even below the snow cover. There are several products in the market that offer some degree of protection. However, there are some claims that some of these products can cause physiological damage to the grass. When some negative effects have been observed, it is not clear if the reason of such damage is an individual product or a combination or mixture of products. It is uncertain also the rates at which phytotoxicity occurs. Exploring different scenarios is required to address potential problems caused by use of chemicals for winter protection

Objective

The purpose of this trial was to measure the level of phytotoxicity of a large number of fungicides and protective treatments associated with winter damage on creeping bentgrass.

Methods

This study was conducted on creeping bentgrass (*Agrostis stolonifera* L.) at the Horticulture Research Farm in Ames and at Veenker Memorial Golf course, Iowa State University, Ames, Iowa. Two field trials were conducted simultaneously during winter and spring of 2003-2004 and 3 trials were conducted simultaneously during winter and spring of 2004-2005.

The experimental design was a randomized complete block. There were 4 replications, and a variable number of treatments in each trial as described in tables 1 and 2. Both trials in 2003 were covered with an Evergreen tarp over the duration of winter. In 2004-2005 one trial was covered with an Evergreen tarp, another with Green Jacket tarp, and one was left uncovered.

Chemicals were applied on December 7, 2003 and December 8, 2004 with a CO₂ back pack sprayer with a rate of 3 gallons of water per 1000 ft². All chemicals and mixtures were prepared 2 days before spraying and mixed constantly during application. Plastic tarps were placed 10 December both years. Treatments were in place before the first big snow event of the season.

Visual ratings were taken on 24 March, 5 April and 3 May 2004 and on 23 March, 25 April and 18 May of 2005. Color ratings were based on a scale of 1-9 with 9 = dark, 1 = light green and 6 being the least acceptable green color. Anova and LSD tests were performed on the data.

Table 1. Treatment description and application rates used during 2003-2004.

| Treatment # | Description | Rate | |
|-------------|-----------------------|-------------------------|---------------------------------------|
| | | Oz./1000ft ² | ^(a) ml-g/25ft ² |
| 1 | Control | n/a | n/a |
| 2 | Water application | 384 | 285 |
| 3 | Banner Maxx | 3.0 | 2.18 |
| | Daconil Weather Stick | 5.5 | 3.99 |
| 4 | Banner Maxx | 2.0 | 1.45 |
| | Medallion | 0.5 | 0.36 |
| 5 | Banner Maxx | 3.0 | 2.18 |
| | Medallion | 0.5 | 0.36 |
| 6 | Banner Maxx | 2.0 | 1.45 |
| | Medallion | 0.5 | 0.36 |
| | Daconil Weather Stick | 5.5 | 3.99 |
| 7 | Primer select | 4.0 | 2.90 |
| 8 | Leaf shield | 2.0 | 1.45 |
| 9 | Aca 1820 | 6.0 | 4.35 |
| 10 | Regreen | 12.0 | 8.70 |
| 11 | Regreen | 24.0 | 17.40 |
| 12 | Regreen | 12.0 | 8.70 |
| | Banner Maxx | 3.0 | 2.18 |
| | Daconil Weather Stick | 5.5 | 3.99 |
| 13 | Greenlawnger | 32.0 | 25.00 |
| 14 | Evergreenn cover | n/a | n/a |
| 15 | Sand Topdress | 1/8" | 1 gal/plot |
| 16 | Impermeable cover | n/a | n/a |
| 17 | Waterings (3/season) | 10240/ea. | 7800/ea. |
| 18 | PCNB granular | 120 | 85.0 |
| 19 | PCNB WP | 8.0 | 5.80 |
| 20 | PCNB F | 16.0 | 11.60 |

^(a)Units are either milliliter per 25 ft² or grams per 25 ft² depending the nature (liquid or solid) of the product.

Table 2. Treatment description and application rates used during 2004-2005.

| Treatment # | Packed** | Description | Rate | |
|-------------|----------|------------------------------|-------------------------|---------------------------------------|
| | | | Oz./1000ft ² | ^(a) ml-g/25ft ² |
| 1 | | Control | | |
| 2 | 2004 | Banner Maxx | 3.0 | 1.74 |
| | 2004 | Daconil Weather Stick | 5.5 | 3.19 |
| 3 | 2004 | Daconil Weather Stick | 5.5 | 3.19 |
| | 2004 | Medallion | 0.5 | 0.29 |
| 4 | 2004 | Banner Maxx | 3.0 | 1.74 |
| | 2004 | Medallion | 0.5 | 0.29 |
| 5** | 2004 | Banner Maxx | 2.0 | 1.16 |
| | 2004 | Medallion | 0.5 | 0.29 |
| | 2004 | Daconil Weather Stick | 5.5 | 3.19 |
| 6** | 2003 | Leaf shield | 2.0 | 1.16 |
| 7** | 2004 | Regreen | 12 | 6.96 |
| 8** | 2004 | Regreen | 24 | 13.92 |
| 9** | 2004 | Regreen | 12 | 6.96 |
| | 2004 | Banner Maxx | 3.0 | 1.74 |
| | 2004 | Daconil Weather Stick | 5.5 | 3.19 |
| 10** | 2003 | Greenlawnger | 300-1000ml | 20.00 |
| 11** | 2003 | Sand Topdress | 1/8" | 1 gallon |
| 12 | 2003 | PCNB granular | 7.5 lb | 68.00 |
| 13 | 2003 | PCNB WP | 8.0 | 4.64 |
| 14 | 2003 | PCNB F | 16 | 9.28 |
| 15 | 2003 | Banner Maxx | 4.0 | 2.32 |
| 16 | 2003 | Medallion | 0.5 | 0.29 |
| 17 | 2003 | Daconil | 5.5 | 3.19 |
| 18 | 2004 | Banner Maxx | 4.0 | 2.32 |
| 19 | 2004 | Medallion | 0.5 | 0.29 |
| 20 | 2004 | Daconil | 5.5 | 3.99 |

(*) Units are either milliliter per 25 ft² or grams per 25 ft² depending the nature (liquid or solid) of the product.

(**) Indicates how old the product was when it was used. Products packed in 2003 used on 2004-2005 are the same as those used in 2003-2004.

(***)Treatments were not applied on covered plots.

Results

During 2003, the Banner Maxx-plus-Medallion and the PCNB treatments caused the majority of damage observed in this study (Table 2). Color dye treatments and plastic cover treatments were statically better than control during the first 2 evaluations.

High ratings during the first and second evaluation period are likely a product of dye colors. Green dye avoids clear observation of the grass. During the last evaluation, the dyes had faded or the grass had been mowed enough to expose new tissue; thus, color ratings have no interference at this time.

The last evaluation was performed on 3 May when all plots seemed to have recovered successfully from winter, even on plots that showed very poor color early on the season.

Table 3. Color ratings of creeping bentgrass at two sites during 2004.

| Treatment description | Color ratings | | | | | |
|--|---------------------|-------|-------|-------------------|-------|-------|
| | Veenker Golf Course | | | Horticulture farm | | |
| | 24-Mar | 5-Apr | 3-May | 24-Mar | 5-Apr | 3-May |
| Control | 4.00 | 5.67 | 7.50 | 4.20 | 5.40 | 7.50 |
| Water application | 4.67 | 7.00 | 7.33 | 4.80 | 5.80 | 6.80 |
| Banner Maxx Daconil Weather Stick | 1.33 | 4.00 | 7.50 | 2.00 | 3.20 | 7.00 |
| Banner Maxx Medallion | 1.33 | 5.00 | 7.00 | 2.40 | 3.00 | 7.20 |
| Banner Maxx Medallion | 1.33 | 4.67 | 7.33 | 1.80 | 2.80 | 6.90 |
| Banner Maxx Medallion Daconil Weather Stick | 1.00 | 4.00 | 7.50 | 1.80 | 3.20 | 7.10 |
| Primer select | 4.33 | 6.00 | 7.67 | 5.00 | 5.80 | 7.40 |
| Leaf shield | 5.33 | 6.00 | 7.33 | 4.20 | 4.20 | 7.20 |
| Aca 1820 | 3.33 | 6.33 | 7.50 | 3.60 | 4.80 | 7.40 |
| Regreen | 9.00 | 9.00 | 7.00 | 9.00 | 9.00 | 8.00 |
| Regreen | 9.00 | 9.00 | 7.00 | 9.00 | 8.00 | 8.00 |
| Regreen | 9.00 | 9.00 | 7.50 | 9.00 | 9.00 | 8.00 |
| Banner Maxx Daconil Weather Stick | | | | | | |
| Greenlawnger | 9.00 | 9.00 | 7.67 | 9.00 | 8.00 | 7.80 |
| Evergreenn cover | 6.67 | 7.00 | 7.33 | 8.00 | 7.60 | 7.40 |
| Sand Topdress | 5.00 | 6.00 | 7.33 | 6.00 | 6.40 | 7.80 |
| Impermeable cover | 8.00 | 7.67 | 7.67 | 8.00 | 6.40 | 7.50 |
| Waterings (3/season) | 4.33 | 6.00 | 7.33 | 5.00 | 6.00 | 7.30 |
| PCNB granular | 3.67 | 7.00 | 7.33 | 4.80 | 5.20 | 7.60 |
| PCNB WP | 3.67 | 6.33 | 7.83 | 4.60 | 4.80 | 7.20 |
| PCNB F | 1.00 | 6.33 | 7.50 | 3.00 | 4.60 | 7.20 |
| LSD_{0.05} | 1.42 | 1.39 | 0.56 | 1.10 | 2.05 | 0.47 |

After observing the results of 2003, another set of trials was planned for 2004-2005 to validate the data. During the second year, another cover was evaluated (Green Jacket) and one trial was left uncovered.

Table 4. Color ratings of creeping bentgrass at Veenker Golf Course during 2005. Data collected on uncovered plots.

| Packed | Description | Color ratings | | |
|--------|-----------------------|---------------|--------|--------|
| | | 23-Mar | 25-Apr | 18-May |
| | Control | 2.0 | 7.0 | 8.5 |
| 2004 | Banner Maxx | 2.0 | 7.0 | 8.5 |
| 2004 | Daconil Weather Stick | | | |
| 2004 | Daconil Weather Stick | 2.0 | 6.3 | 8.2 |
| 2004 | Medallion | | | |
| 2004 | Banner Maxx | 1.8 | 6.7 | 8.5 |
| 2004 | Medallion | | | |
| 2004 | Banner Maxx | 1.8 | 6.7 | 8.2 |
| 2004 | Medallion | | | |
| 2004 | Daconil Weather Stick | | | |
| 2003 | Leaf shield | 2.0 | 7.0 | 8.7 |
| 2004 | Regreen | 7.0 | 8.5 | 8.5 |
| 2004 | Regreen | 7.0 | 8.5 | 8.5 |
| 2004 | Regreen | 7.0 | 8.5 | 8.5 |
| 2004 | Banner Maxx | | | |
| 2004 | Daconil Weather Stick | | | |
| 2003 | Greenlawnger | 7.0 | 8.5 | 8.7 |
| 2003 | Sand Topdress | 2.0 | 6.8 | 8.3 |
| 2003 | PCNB granular | 2.0 | 6.0 | 8.2 |
| 2003 | PCNB WP | 2.0 | 6.7 | 8.3 |
| 2003 | PCNB F | 1.2 | 6.3 | 8.3 |
| 2003 | Banner Maxx | 1.7 | 6.3 | 8.3 |
| 2003 | Medallion | 2.0 | 6.7 | 8.3 |
| 2003 | Daconil | 2.0 | 6.7 | 8.3 |
| 2004 | Banner Maxx | 2.0 | 7.0 | 8.3 |
| 2004 | Medallion | 2.0 | 6.5 | 8.3 |
| 2004 | Daconil | 2.0 | 6.8 | 8.3 |
| | LSD _{0.05} | 0.3 | 0.8 | NS |

Table 5. Color ratings of creeping bentgrass at Veenker Golf Course during 2005. Data collected on covered plots.

| Packed | Description | Color ratings | | | | | |
|--------|-----------------------|--------------------|--------|--------|-----------------|--------|--------|
| | | Green Jacket Cover | | | Evergreen Cover | | |
| | | 23-Mar | 25-Apr | 18-May | 23-Mar | 25-Apr | 18-May |
| | Control | 6.0 | 7.0 | 8.5 | 7.8 | 7.0 | 8.5 |
| 2004 | Banner Maxx | 5.8 | 7.0 | 8.5 | 7.7 | 7.0 | 8.7 |
| 2004 | Daconil Weather Stick | | | | | | |
| 2004 | Daconil Weather Stick | 6.2 | 7.0 | 8.3 | 7.8 | 7.0 | 8.5 |
| 2004 | Medallion | | | | | | |
| 2004 | Banner Maxx | 5.0 | 7.0 | 8.3 | 7.5 | 7.0 | 8.5 |
| 2003 | PCNB granular | 6.0 | 6.2 | 8.2 | 7.8 | 6.2 | 8.3 |
| 2003 | PCNB WP | 6.0 | 6.8 | 8.3 | 7.0 | 6.8 | 8.3 |
| 2003 | PCNB F | 4.0 | 6.5 | 8.3 | 5.7 | 6.2 | 8.2 |
| 2003 | Banner Maxx | 5.2 | 7.3 | 8.5 | 7.0 | 7.2 | 8.5 |
| 2003 | Medallion | 6.0 | 7.0 | 8.5 | 7.3 | 7.0 | 8.5 |
| 2003 | Daconil | 6.3 | 7.2 | 8.3 | 7.7 | 7.0 | 8.5 |
| 2004 | Banner Maxx | 5.2 | 7.0 | 8.5 | 7.7 | 7.2 | 8.7 |
| 2004 | Medallion | 5.5 | 7.0 | 8.5 | 7.7 | 7.0 | 8.5 |
| 2004 | Daconil | 5.0 | 7.0 | 8.3 | 7.7 | 7.0 | 8.5 |
| | LSD _{0.05} | 1.2 | 0.6 | NS | 0.7 | 0.3 | NS |

During the second year, none of the treatments that seemed to have problems in 2003 showed significant discoloration except for PCNB. On 23 March, the PCNB F treatment had significantly more discoloration than other treatments (Tables 4 and 5). On 25 April, the PCNB granular treatments showed significant discoloration when compared to other treatments except for PCNB F. On 25 April, the PCNB F showed significant discoloration compared to other treatments only when under the Evergreen cover or when left uncovered.

Variations in results from year to year and under different covers, suggest that other conditions such as temperature, moisture and maybe precipitation during winter and spring may affect the response observed on creeping bentgrass. However, the fungicide PCNB appears to be one with the highest risk of producing phytotoxicity under the conditions evaluated.