# Management of Take-all Patch of Creeping Bentgrass on Greens Constructed to USGA Specifications

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## Objectives

The general objective of this research is to determine the effect of pre-plant and post-plant treatments on the establishment and spread of take-all patch of creeping bentgrass in a sand-based root zone prepared according to USGA specifications. Specific objectives include:

1. assessing the development of take-all patch on bentgrass planted in USGA root zones adjusted to three different pH levels.
2. comparing root zone acidification treatments and fungicide applications for take-all control.

## Rationale

Take-all patch, caused by *Gaeumannomyces graminis* f. sp. *avenae*, is favored by alkaline soils. Because the calcareous sands used for putting greens in the Midwest have a high pH, bentgrass greens constructed with high sand content or to USGA specifications are especially prone to the disease. The proposed research is designed to investigate options for avoiding or reducing the potential severity of take-all problems before they occur. By altering the pH in the top one or two inches of substrate (prior to establishment of creeping bentgrass turf) to levels that do not favor pathogen growth and disease development, outbreaks of take-all patch may not occur, or may be easily and more economically managed with maintenance treatments to established turf.

## How It Was Done

The experimental design was a randomized split plot, with whole plots represented by the target pH (5.5, 6.5, and 7.5). The pH of the root zone mix was 7.5. The adjustments to 6.5 and 5.5 were made by incorporating acidifying amendments such as aluminum sulfate and ammonium sulfate. The subplots involve different combinations of nitrogen fertilizer and fungicide application.

Prior to seeding, the whole plots designated pH 5.5 and 6.5 were treated with aluminum sulfate at rates equivalent to 1.79 lb/cubic yard and 5.48 lb/cubic yard, respectively. The aluminum sulfate was lightly incorporated into the top 1-2 inches of the root zone mix. Once the turf was established, aluminum sulfate was applied to the 5.5 and 6.5 target pH plots on June 1, and Aug 31. Subplots were treated with ammonium sulfate (21-0-0) or a complete fertilizer (18-4-10) on Sep 16, and Oct 9, 1998 at a rate equivalent to 0.75 lb N per 1000 sq. ft. Fungicide (Banner Maxx at 2.0 fl oz per 1000 sq. ft.) was applied to appropriate plots on Oct 16, 1998.

Introduction of the pathogen into the treatment plots was attempted on two separate occasions. On June 1, approximately 25 g of millet seed infested with *Gaeumannomyces graminis* f. sp. *avenae (Gga)* was placed into the turf after a 1 inch deep soil core was removed from 3 sites in each treatment plot. The soil cores were then replaced over the inoculum. On July 1, plugs of *Gga*-infested creeping bentgrass that were collected from a local site with symptoms of take all patch were introduced into the plots. One plug was placed in the center of each of the 48 treatment plots.

**Results for 1999**

- Initial expression of take all patch symptoms occurred in April 1999 (nearly a year after inoculation), as the turf emerged from dormancy and resumed growth. Disease developed precisely at the inoculation sites in the experimental plots. Disease development was evaluated visually using a devised 0-3 take all patch severity index on April 8, May 6, June 10, and July 8, 1999. The severity index is described below.

  Take all patch severity index:
  0 = take all patch symptoms were not evident
  1 = take all patch symptoms consisted of relatively inconspicuous patches of thin turf at the inoculation sites
  2 = take all patch symptoms consisted of well defined patches of thin and chlorotic turf at the inoculation sites
  3 = take all patch symptoms consisted of well defined patches of orange and brown turf around the inoculation sites

- Reduced pathogen activity due to elevated root zone mix temperatures resulted in a remission of symptoms from mid-July through late October, 1999. Results for the four evaluation dates were consistent in that disease levels were reduced with fungicide treatments and ammonium sulfate application. Also, there were declining levels of disease in plots where the upper inch of root zone mix was acidified with aluminum sulfate prior to inoculation in the spring 1998.
- Results of evaluations recorded in April 1999 are shown in Table 1. Plots that were treated with fungicide sustained significantly less disease development that unsprayed plots. Where no fungicide was used, the ammonium sulfate treatment (21-0-0) resulted in significantly less take all patch development (index = 0.97) than where the balanced fertilizer (18-4-0) was used (index = 2.19). Differences in disease development among the three target pH levels were not significant at $P \geq 0.05$. However they were significant at $P \geq 0.10$ and therefore are noteworthy because mean disease index values were diminished at the 5.5 target pH.
- The evaluations recorded in May (Table 2) revealed similar results. Significantly less disease occurred in plots where fungicide was used and where the ammonium sulfate was used at the nitrogen source. As expected, symptom expression was greatest where no fungicide and the balanced fertilizer were applied. Symptom expression was mild where ammonium sulfate and fungicide were applied. Results also show a significant reduction in disease severity with pH.
- Evaluations recorded in June revealed a lessening of symptom expression for all treatments (Table 3). Significant differences were evident between the fungicide treatments and the sources of nitrogen fertilizer. Also, plots with the lower target pH values had reduced severity indices compared with the pH 7.5 unamended root zone mix (indices = 0.60 and 0.50 for pH 6.5 and 5.5, respectively).

- The decline of symptom expression continued into July, where the mean severity index values ranged between 1.10 and 0.15 over all treatments (Table 4). Differences between fungicide treatments and nitrogen sources were statistically significant at P≥0.05, but they were not as obvious visually as in previous months. Also, the reduction in disease development with reduced target pH was significant at the P≥0.01 level.

Table 1. Take all patch severity index ratings were recorded in April, 1999. Values represent the mean of 4 replications.

| | Target pH | | | |
|---|---|---|---|---|
| Treatment | 7.5 | 6.5 | 5.5 | Treatment means |
| No fungicide / N (21-0-0) | 1.08 | 1.17 | 0.67 | 0.97 |
| Fungicide / N (21-0-0) | 0.08 | 0.42 | 0.42 | 0.31 |
| No fungicide / N (18-4-10) | 2.75 | 2.00 | 1.83 | 2.19 |
| Fungicide / N (18-4-10) | 0.33 | 0.33 | 0.25 | 0.31 |
| Target pH mean | 1.00 | 0.98 | 0.79 | |

Table 2. Take all patch severity index ratings were recorded in May, 1999. Values represent the mean of 4 replications.

| | Target pH | | | |
|---|---|---|---|---|
| Treatment | 7.5 | 6.5 | 5.5 | Treatment means |
| No fungicide / N (21-0-0) | 2.00 | 1.00 | 1.42 | 1.47 |
| Fungicide / N (21-0-0) | 0.67 | 1.08 | 0.50 | 0.75 |
| No fungicide / N (18-4-10) | 2.67 | 2.42 | 1.83 | 2.31 |
| Fungicide / N (18-4-10) | 1.83 | 1.42 | 1.00 | 1.42 |
| Target pH mean | 1.80 | 1.50 | 1.20 | |

Table 3. Take all patch severity index ratings were recorded in June, 1999. Values represent the mean of 4 replications.

| Treatment | Target pH 7.5 | 6.5 | 5.5 | Treatment means |
|---|---|---|---|---|
| No fungicide / N (21-0-0) | 1.67 | 0.67 | 0.75 | 1.03 |
| Fungicide / N (21-0-0) | 0.25 | 0.33 | 0.25 | 0.28 |
| No fungicide / N (18-4-10) | 1.92 | 0.83 | 0.58 | 1.11 |
| Fungicide / N (18-4-10) | 0.92 | 0.58 | 0.25 | 0.58 |
| Target pH mean | 1.20 | 0.60 | 0.50 | |

Table 4. Take all patch severity index ratings were recorded in July, 1999. Values represent the mean of 4 replications.

| Treatment | Target pH 7.5 | 6.5 | 5.5 | Treatment means |
|---|---|---|---|---|
| No fungicide / N (21-0-0) | 1.10 | 0.33 | 0.15 | 0.53 |
| Fungicide / N (21-0-0) | 0.18 | 0.15 | 0.15 | 0.16 |
| No fungicide / N (18-4-10) | 1.08 | 0.33 | 0.23 | 0.55 |
| Fungicide / N (18-4-10) | 0.65 | 0.33 | 0.15 | 0.38 |
| Target pH mean | 0.75 | 0.29 | 0.17 | |