Silicon Amendment: A Component of an Integrated Gray Leaf Spot Management Strategy

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Objectives:

1. To evaluate accumulation of silicon in perennial ryegrass plants.
2. To determine the effects of soil type, source of silicon, and rate of silicon amendment on gray leaf spot severity and incidence.
3. To devise a management strategy for gray leaf spot through integration of silicon into a fungicide program.

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Gray leaf spot, caused by *Magnaporthe oryzae*, is a serious disease of perennial ryegrass turf that can cause extensive damage to turf in golf course fairways. The disease is effectively managed by fungicide applications. However, turf managers often explore the possibilities of various cultural practices that can be relatively easily integrated along with fungicide into a broader disease management strategy.

Soil silicon amendment have been proven effective in controlling both soilborne and foliar fungal diseases of several plants including some turfgrass species. However, the effects of silicon on gray leaf spot development of perennial ryegrass turf were not known. This study was undertaken to investigate the effects of silicon on gray leaf spot incidence and severity in perennial ryegrass.

The experiments were set up in Willow Hollow Golf Course and Lulu Temple Country Club in Pennsylvania in a split-plot design with rate of silicon as the main-plot factor and rate of fungicides as the split-plot factor. Silicon (calcium silicate) was applied at six different rates: 0, 0.5, 1, 2, 5, and 10 metric ton/ha. The fungicides selected for the study were: a systemic fungicide, azoxystrobin, and a contact fungicide, chlorothalonil. Each fungicide was sprayed at low, medium, and high label rates - 0.31, 0.46 and 0.61 a.i. kg/ha azoxystrobin, and 4.53, 6.29 and 8.18 a.i. kg/ha chlorothalonil, respectively. Calcium silicate was broadcast as a top dressing in each treatment plot (76.2 x 45.7 cm) and incorporated by core aeration using a Toro procore 660 open-tine. The cores were 1.9 cm in diameter and 7.6 cm in depth at 7.6 cm x 7.6 cm spacing.

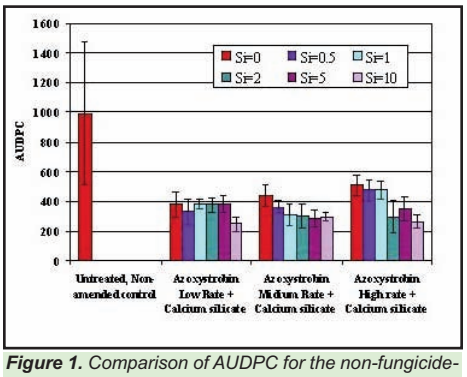

Figure 1. *Comparison of AUDPC for the non-fungicide-treated and non-amended control, low, medium and high rates of azoxystrobin, and all treatments of azoxystrobin combined with calcium silicate treatments at Site 1.*

The grass in the plots was maintained at a 3.5 cm height and mowed twice a week. The grass was fertilized with (5% N, 5% P_2O_5 and 20% K_2O) at 1.22 x 10^{-3} kg/m^2 with Team for crabgrass control before the experiments was initiated. Fungicides were applied six weeks after application of silicon and repeated after 14 days to deliver two applications prior to inoculation with *Magnaporthe oryzae* (60 x10^3 conidia/ml H_2O with 0.1% Tween 20).

Fungicides were applied in water equivalent of 814 L/ha (2 gallons/1000 sq ft). Disease severity (index 0-10; 0=turf area asymptomatic, 10=91-100% of turf area necrotic) was assessed weekly for six weeks. Disease progress over time was evaluated using the parameter estimates, rate r, and AUDPC, where r=rate of disease progress and AUDPC = area under the disease progress curve. Data were analyzed using regression and ANOVA procedures.

The results showed that effects silicon and fungicide on gray leaf spot severity were significant (P=0.05). Assessment of the disease showed that gray leaf spot severity (weekly), rate parameter, r, and the area under disease progress curve (AUDPC; severity-weeks) were significantly reduced by application of silicon and fungicides.

Although all three rates of each of the systemic or contact fungicide reduced gray leaf spot severity similarly, combination of silicon and the fungicide provided further reduction of the disease. Increased rate of silicon application in combination with fungicide generally provided greater reduction of gray leaf spot.

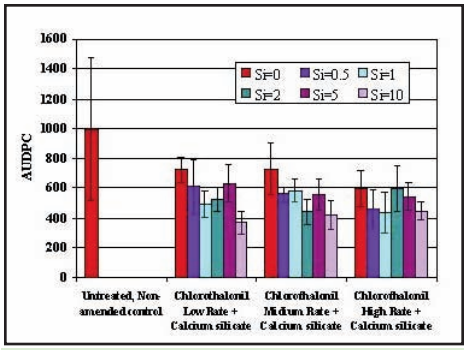

Figure 2. *Comparison of AUDPC for the non-fungicide-treated and non-amended control, low, medium and high rates of chlorothalonil, and all treatments of chlorothalonil combined with calcium silicate treatments in Site 1.*

This study demonstrates that control of gray leaf spot in perennial ryegrass by fungicide application may be augmented by amendment of soil with silicon. This study suggests that silicon may be used as an important component of an integrated gray leaf spot management strategy that includes cultural and chemical approaches.

Future studies are warranted to determine the residual effects of silicon on gray leaf spot development in silicon-amended soil over time and interactions between silicon and various commonly used fungicides for gray leaf spot control.

Summary Points

- Gray leaf spot severity was significantly reduced by amendment of soil with silicon.
- Effects of fungicides on gray leaf spot were augmented by application of silicon.
- Increased rate of silicon application generally provided greater suppression of the disease within the fungicide treatments.