BIOLOGICAL CONTROL OF TURFGRASS DISEASES

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INTRODUCTION

Investigation into novel methods of managing turfgrass diseases is a constant process. This process is driven by the need for new management techniques due to the development of resistance by pathogens to current fungicides, as has occurred with dollar spot resistance to the DMI fungicides, as well as the loss of pesticides due to environmental regulations, as with dyrene and the mercury compounds. Research into new management tools has focused around development of new chemicals, composts, and biological controls.

Biological controls involve the management of pathogen populations by introduction of antagonistic organisms. Of over 100 organisms screened in previous studies, two were chosen for further study based on their antagonistic qualities toward dollar spot (Sclerotinia homoeocarpa) and summer patch (Magnaporthe poae) in laboratory studies. Further work examining the mode of antagonism by these bacteria has resulted in the isolation of a novel antibiotic compound. Foliar applications of these bacteria as biological control agents against dollar spot in the field has failed to provide disease management. The effectiveness of these bacteria for the management of summer patch in field conditions has not yet been established due to a lack of sufficient disease pressure. However, the application of the purified antibiotic from the bacteria provided significant dollar spot management in the 1992 field study. The 1993 field study investigated the application of bacterial extract at different rates and application intervals for the management of dollar spot and summer patch.

Compost products have also received recent attention for disease management. Results of the 1992 field study suggesting that the composting product Compost Plus (Ringer Corp.) provides effective dollar spot management was reevaluated in the 1993 study.

DOLLAR SPOT

Materials and Methods

The 1993 dollar spot study was conducted on Emerald creeping bentgrass (Agrostis palustris) at the Hancock Turfgrass Research Center, East Lansing, MI. The study was set up as a randomized complete block design with four replications and plot sizes of 3' x 4'. The study was initiated July 27, 1993. All plots were fertilized every two weeks to deliver a rate of ½ lb N/1000 ft^2 with an 18-4-10 formulation. Two chemical controls were used in this study. Bayleton was applied to deliver 0.08 g AI/m^2 (21 days) and 0.16 g AI/m^2 (14 days). Chlorothalonil was applied at 0.16 and 0.48 g AI/m^2 at 10 day intervals. The bacterial antibiotic was applied at rates and intervals equal to those of the chemical control

treatments. The antibiotic was insoluble in water and therefore, formulated in 1:1 hexane:acetone with 20% Tween 80 used as a surfactant. This was mixed with distilled water and applied with a CO_2 hand sprayer. Ratings were taken at 14 day intervals by a direct count of the number of lesions per plot. Data was analyzed by Tukey's test at a 95% level of confidence.

Results

Difficulties with the formulation of the bacterial extract were experienced in the first two 10 day interval applications of the extract in this study which caused the extract to precipitate from solution, resulting in reduced rates of application. Extract applications at 0.15 g AI/m² (14 days) and 0.48 g AI/m² (10 days) provided disease management significantly better than the untreated control. This disease reduction was not equal to those of Bayleton at 0.15 g AI/m² (14 days) or Daconil 0.48 g AI/m² (10 days). The extract did not significantly reduce disease levels at the 0.08 g AI/m² (21 day) or 0.16 g AI/m² (10 day).

Compost Plus at both rates of application provided significantly reduced disease levels with comparison to the untreated control.

Discussion

The bacterial antibiotic provided the greatest disease management at the 0.48 (10 day) and 0.15 g AI/m² (14 day) rates. The 0.16 g AI/m² (10 day) and 0.08 g AI/m² (21 day) rate failed to provide disease management. The failure of the 0.16 g AI/m² (10 day) rate is likely due to the formulation difficulties experienced in the initial weeks of this study which handicapped these treatments for the rest of the season. Proper applications of the 10 day antibiotic treatments may have resulted in the disease management equal to the commercial products.

The formulation of the bacterial antibiotic was prepared to facilitate application of the extract, and did not address factors such as active ingredient stability, UV protection, or ability to adhere to the plant surface. Further improvements in formulation chemistry may also result in improved disease management.

The results of the 1992 and 1993 field study warrant further study of the efficacy of this bacterial extract as a disease management tool.

SUMMER PATCH

Materials and Methods

Field study of the management of summer patch (Magnaporthe poae) with the two bacteria strains were conducted on annual bluegrass (Poa annua) fairways with histories of infection at Dearborn Country Club, Dearborn, MI, and at the Highlands, Grand Rapids, MI. The study was conducted as a randomized complete block design with four replications and 6' x 9' plots. Fertility was maintained by monthly applications of 18-5-9 fertilizer at a rate of ½ lb N/month. Treatments were applied on a monthly basis through September with the first occurring when the soil temperature reached 18 C at a 5 cm depth. Bacteria were cultured for 24 hours in a liquid broth and applied at a rate of 10^6 bacteria per cm² using a hand sprayer with nitrogen gas. Ratings were taken at a 14 day interval through October.

Field evaluation of the bacterial antibiotic was conducted at the Dearborn Country Club. The antibiotic was applied at rates of 0.12 and 0.25 g AI/m² on a monthly basis. A control treatment of Banner was also applied at equivalent rates of active ingredient.

Results

Due to lack of uniformity in disease expression no significant differences were discernable between any of the treatments.

Discussion

As the bacteria tested were isolated from a soil environment and are strong antagonists in vitro they should be further evaluated against soilborne pathogens. The bacterial antibiotic should also be reevaluated for the management of summer patch.