## Introduction

The purpose of these research studies is to evaluate valid alternative methods of pest control for use in integrated turf management systems. Projects investigate alternative pest control methods that include:

- Biological control
- Nonchemical control including cultural and mechanical practices
- Allelopathy
- Selection and breeding for pest resistance
- Ecological balance of turfgrass species
- Application of integrated turf management practices utilizing IPM and low cultural inputs

## *University of California, Riverside*

*Investigation of Turf Disease Decline for Potential Development of Biological Control Methods - Dr. William L. Casale and Dr. Howard D. Ohr*

In response to environmental concerns and increasing restrictions on the use of chemical pesticides, alternative disease control methods must be developed to reduce our reliance on these materials. Biocontrol of plant disease through the use of "beneficial" microorganisms that are antagonists of disease-causing microorganisms is one such alternative. Since March 1991, sites where disease has declined naturally were investigated for potential biocontrol agents. The disease decline at these sites may be due to increased activity of indigenous microorganisms antagonistic to the pathogen.

A total of 147 microbial organims were isolated from a UCR bermudagrass plot showing decline of spring dead spot caused by *Leptosphaeria korrae*. Disease had spread sufficiently so that green, symptomless patches were obvious in the center of brown, diseased areas; hence, a comparison of microbial profiles from each of these areas could be performed. Among this collection are 41 bacteria and 19 fungi which inhibited the growth of *Sclerotium rolfsii* (cause of southern blight) by antibiosis and 6 fungi that parasitized *S. rolfsii*. Growth of *Rhizoctonia solani* (cause of brown patch) was inhibited by 25 bacteria and 26 fungi from the collection. At the time of this report, tests with *L. korrae* were not completed.

In greenhouse experiments, two bacterial isolates, JT78 and JT80, were most effective at reducing disease caused by *S. rolfsii* and *R. solani* in perennial rye. No detrimental effects were observed on plants by these biocontrol agents, even when applied at high concentrations. Field testing the potential of biocontrol agents was initiated at two bermudagrass plots infected with *L. korrae* and results are pending.

Identification of disease decline sites in California, studies to determine the disease-suppressiveness of turf samples from these sites, and a comparison of virulence of pathogens from these sites are continuing.

## *University of Florida*

*Pathogenicity and Biological Control of Gaeumannomyces-like Fungi - Dr. Monica Elliott*

The two objectives of this project are to: 1) develop a model system for determining the relationship between melanization of fungal structures and pathogenicity (ability to cause disease) of *Gaeumannomyces* species and related fungi, and 2) determine the biological control potential of non-pathogenic mutant strains of *Gaeumannomyces* fungi for control of turfgrass patch diseases.

At least six turfgrass patch diseases are caused by soil borne fungi with dark-pigmented (melanized) hyphae and an ectotrophic growth habit on roots. These diseases include summer patch and necrotic ring spot of Kentucky bluegrass, take-all patch of bentgrass, spring dead spot and bermudagrass decline of bermudagrass, and take-all root rot of St. Augustinegrass. *Gaeumannomyces graminis* var. *graminis* is associated with the diseases on bermudagrass and St. Augustinegrass grown in the southern United States.

All of these fungi are 'ectomycorrhizal' which means they colonize roots, and therefore, move with the roots. For vegetatively-propagated turfgrass, the pathogen, if present in the sod fields, will be moved with the turfgrass to the new planting location. One method for control would be to introduce a biological control agent into the new planting location prior to planting. An organism that could occupy the same niche as the pathogen would be a viable candidate for biological control. One such group of organisms are mutants of the pathogens that have been rendered non-pathogenic.

DHN (1,8-dihydroxynaphthalene) melanin plays an important role in the fungal cell wall. Inhibition of the production of DHN melanin was demonstrated to be a disease control method, primarily with the plant pathogens *Pyricularia oryzae* and *Colletotrichum* spp. Compounds which inhibit DHN melanin were evaluated in the laboratory for their ability to inhibit the growth of the fungi and to inhibit disease expression. The results indicate that the melanin in *G. graminis* var. *graminis, G. incrustans* and *Magnaporthe poae* is DHN melanin. However, inhibition of melanin production did not appear to inhibit their ability to cause disease.

A total of 170 "presumed" mutants of parent strain *G. g. graminis* FL-39 were obtained, primarily using the mutagen N-methyl-N-nitro-N-nitrosoguanidine (MNNG). Among these mutants, 135 were still as pathogenic *in vitro* as the parent FL-39 strain. Two mutants were not pathogenic, seven were intermediate in pathogenicity and two were slightly less pathogenic than the parent strain. All of the non-pathogenicand intermediate-pathogenic mutants had also lost the ability to consistently produce perithecia.

Fifteen mutants of FL-39 have been selected for testing *in vitro*. These are currently being grown on sterile ryegrass seed for use as inoculum sources. All fifteen isolates have been stable in storage and are growing as rapidly on the ryegrass seed as the parent strain. This inoculum will be used in three different methods for evaluation of biological control activity: 1) Simultaneous inoculation of sterilized topsoil mix with a mutant and a pathogenic strain of *G. g. graminis* prior to planting with pathogen-free bermudagrass sprigs, 2) Inoculation of sterilized topsoil mix with a mutant two weeks prior to infestation with a pathogenic strain and planting with pathogen-free bermudagrass sprigs, and 3) Inoculation of sterilized topsoil mix with a mutant followed by planting *G. g. graminis* infected bermudagrass plants. The results from this study will determine the effectiveness of using mutants strains of turf pathogens as alternative pest management methods.

## *Cornell University*

*Microbial Basis of Disease Suppression in Composts Applied to Golf Course Turf - Dr. Eric B. Nelson*

The overall goal of this project is to develop more effective biological control strategies with compost-based organic fertilizers by understanding the microbial ecology of disease-suppressive composts. In particular, we hope to understand the microbiology to help predict disease-suppressive properties of composts and discover an assemblage of beneficial microorganisms useful in the development of microbial fungicides for turfgrass disease control.

The specific objectives of our study are to 1) determine the spectrum of turfgrass pathogens suppressed by compost applications, 2) establish relationships between overall microbial activity, microbial biomass, and disease suppression in composts, 3) identify microorganisms from suppressive composts that are capable of imparting disease suppressive properties to conducive composts or those rendered conducive by heat treatment, and 4) determine the fate of compost derived antagonists in golf course putting greens following application of individual antagonists and composts fortified with these antagonists.

The suppressiveness of various composts to turfgrass disease caused by two different *Pythium* species and *Typhula incarnata* were established. In field studies, some composts are as effective as standard fungicides in suppressing *Pythium* root rot and *Typhula* blight on creeping bentgrass putting greens.

Laboratory studies have focussed on *Pythium* incited disease of creeping bentgrass. Disease suppression by some composts was a result of microbial activity, whereas suppression in other composts was due to non-microbiological factors. In general, immature composts (less than 1 yr old) were less suppressive to *Pythium* than mature composts (greater than 1.5 yr old). Sterilization of some composts eliminated disease-suppressive properties. These results further indicate a microbiological nature to disease suppression in these composts. In examining a number of suppressive and conducive composts, a direct relationship between microbial activity and disease suppression was established.

Over the past year, efforts were focussed on recovering specific isolates of bacteria, fungi, and actinomycetes from suppressive composts. Bacteria, fungi, and actinomycetes from over 20 different composts were isolated. Actinomycetes have been the most difficult group to enumerate and purify since they are extremely slow-growing and cultures can be easily contaminated with bacteria and fungi. A triple layer agar technique was employed to better recover antibiotic producing actinomycetes. Over 100 strains of actinomycetes are currently being evaluated for their disease-suppressive