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:

1. Biological control;
2. Nonchemical control including cultural and mechanical practices;
3. Allelopathy;
4. Selection and breeding for pest resistance;
5. Ecological balance of turfgrass species; and
6. 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

Increasing restrictions on the use of chemical pesticides demands a shift in emphasis from chemical control to alternative disease control methods. One alternative is the biological control of plant disease through the use of "beneficial" microorganisms that are antagonists of disease-causing microorganisms. This is the first year of a project to investigate sites, where disease has declined naturally, as potential sources of microorganisms for the development of biological control methods. Increased activity of antagonistic microorganisms may be associated with disease decline expressed at a site over several seasons, or within the green, recovered central areas that often appear within brown, symptomatic patches of turf as the disease spreads.

The study was initiated with a bermudagrass field plot previously inoculated with *Leptosphaeria korrae* (cause of spring dead spot) at the University of California at Riverside (UCR) Experiment Station. 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. Thus far, 135 different bacteria and fungi have been isolated from this UCR field plot. These microorganisms are being tested for the ability to reduce growth of several turfgrass pathogens (*Leptosphaeria korrae, Sclerotium rolfsii*, and *Rhizoctonia solani*) in culture. Experiments are also underway to test the most promising microorganisms for their ability to reduce disease in the greenhouse.

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 planned for the next project year.

Dr. William Casale
Dr. Howard Ohr

University of Florida

Pathogenicity and Biological Control of Gaeumannomyces-like Fungi

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 five turfgrass patch diseases are caused by soilborne 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, spring dead spot and bermudagrass decline of bermudagrass, and take-all patch of bentgrass. The causal agents of these diseases are *Magnaporthe poae, Leptosphaeria korrae, L. narmari, Ophiosphaerella herpotricha, Gaeumannomyces graminis var. graminis,* and *G. graminis var. avenae*. DHN (1,8-dihydroxynaphthalene) melanin is the most common fungal cell wall melanin. Inhibition of the production of DHN melanin has been demonstrated to be a disease control method, primarily with the plant pathogens *Pyricularia oryzae* and *Colletotrichum* spp. In addition, melanin deficient mutants of these species are capable of colonizing plant tissue, but can not penetrate the plant tissue.

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 does not appear to inhibit their ability to cause disease.

Seventy-five mutant strains of *G. graminis* var. *graminis* have been obtained. Twenty-nine have been evaluated for their ability to cause disease. All strains were still pathogenic; however, their ability to produce the sexual spores of this fungus and a structure called a hyphopodia were severely impaired. The remaining strains must be evaluated before we will know if this will be a viable method for obtaining biological control of patch diseases.

Dr. Monica Elliott

Cornell University

Microbial Basis of Disease Suppression in Composts Applied to Golf Course Turf

The 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. The specific objectives of this 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 or composts fortified with these antagonists.

The suppressiveness of various composts to turfgrass disease caused by two different *Pythium* species and *Typhula incarnata* has been established. This extends the range of turfgrass pathogens already known to be suppressed by compost applications. 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. We have shown that disease suppression in some composts is a result of microbial activity, whereas suppression in other composts is due to non-microbiological factors. In general, immature composts (less than 1 yr old) are less suppressive to *Pythium* than mature composts (greater than 1.5 yr old). Sterilization of some composts eliminates 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, we have shown direct relationships between microbial activity and disease suppression.

In preliminary experiments with a poultry manure compost, populations of fungi and actinomycetes were quite low, whereas populations of bacteria ranged from 4.4 to 7.5 million cells per gram of compost. Current studies are focussing on the qualitative microbiological differences between suppressive and conducive composts, and the interactions of specific microorganisms with turfgrass pathogens. Our goal is to determine the key microorganisms inhabiting composts so that their physiology and ecology might be better understood. This information will be important in predicting whether composts, at particular stages of maturity, will be suppressive under a set of environmental conditions.

Dr. Eric Nelson

Iowa State University

Potential for Physiological Management of Symptom Expression by Turfgrass Infected by Bipolaris sorokiniana

Ethylene has been found to contribute substantially to the loss of chlorophyll in leaves of *Poa pratensis* infected by *Bipolaris sorokiniana* (leaf spot). The physiological basis of the elevated endogenous ethylene levels is unknown, however. This research project was initiated to determine if the endogenous ethylene, or its mode action, could be manipulated to prevent the loss of chlorophyll in infected leaves and thereby prevent yellowing. The ultimate objective is to develop a means of controlling disease symptom expression. Infection would not be prevented, but yellowing would not