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

properties.

Currently, the fungal and bacterial populations from composts are being characterized and screened for disease suppression. Through successful refinement of the microbial biomass assay, repeatable standard curves from both inorganic phosphate and glycerol phosphate can be generated. During the first half of 1993, over 25 different materials will be assessed for levels of biomass and activity to determine whether this method will be suitable predicting disease suppressive properties of composts.

Iowa State University

Potential for Physiological Management of Symptom Expression by Turfgrass Infected by Bipolaris sorokiniana - Dr. Clinton F. Hodges

Ethylene is generated inside the leaves of *Poa pratensis* in response to infection by *Bipolaris sorokiniana* and contributes substantially to the loss of chlorophyll from the infected leaves. This research project was initiated to determine if the ethylene, or its mode of action, can be manipulated to prevent the loss of chlorophyll in infected leaves and prevent yellowing. Prevention of ethylene induced yellowing could result in the control of symptom expression, specifically yellowing of infected turf, independent of the infection. This could reduce use of fungicides and provide a new approach to disease management.

Research conducted in the last year has concentrated on decreasing ethylene in infected leaves by applying ethylene inhibiting substances to roots of inoculated plants. The following materials have been evaluated for their effectiveness when applied to the soil:

- Aminooxyacetic Acid (AOA)
- Aminoisobutyric Acid (AIBA)
- Benzoic Acid (BNZ)
- Canaline (CAN)
- Carbonyl Cyanide m-Chlorophyenylhydrazone (CCCP)
- Cobalt Chloride (COCL)
- Propyl Gallate (PGA)

Ethylene in healthy leaves ranged from 276 to 321 $\mu L\ L^{-1}$. Ethylene within inoculated leaves increased after 24 hours, peaked at 48 hours (1476 $\mu\ L\ L^{-1}$), and then declined at 72 hours and 96 hours. CAN, AOA, CCCP, and PGA applied to roots reduced leaf ethylene in response to infection.

Of the materials that decreased ethylene, only CAN and AOA prevented substantial loss of chlorophyll. Inoculated leaves of plants treated with CAN and AOA retained 74 and 80 percent of their chlorophyll, respectively. Preliminary results from leaf treatments with CAN and AOA show a greater decrease in the surge of ethylene associated with infection than that achieved with soil treatment. Ethylene levels have averaged 30 percent of that in inoculated controls with as much as a 91 percent retention of chlorophyll.

These observations suggest that manipulation of symptom expression in this host-pathogen interaction (and perhaps others) is feasible. Our 1993, studies will concentrate on the function and control of the senescence processes during pathogenesis. Understanding symptom response at this basic level may help develop new control measures or lead to genetic clues on how to develop resistant varieties.

USDA, Rutgers University, University of California

Biological Control of Turf Pests: Isolation and Evaluation of Nematode and Bacterial Pathogens - Dr. Michael G. Klein, Dr. Randy R. Gaugler and Dr. Harry K. Kaya

The objectives of this project are to obtain new strains and species of nematodes and bacteria, which attack white grub insects and to characterize those with the greatest activity against grub larvae. The current need for better biological control agents for use against grubs, such as the Japanese beetle and masked chafers, creates an opportunity to license promising new pathogens to industries for development and commercialization. This cooperative effort between the U. S. Golf Association and a team of U. S. Department of Agriculture and university scientists in Ohio, New Jersey, and California has generated interest from the media and resulted in increased visibility for the USGA's Environmental Research Program.

During the first two years, more than 125 strains and potential new species of entomopathogenic nematodes (i.e., insect/disease causing) were recovered. Four described species, and several possible new species have been isolated by both Ohio and New Jersey scientists from golf course turf and scarab larvae. Additional strains, and possible new species from the two major genera of nematodes,