

Ohio State University - Dr. Karl Danneberger

Mechanisms for Heat Tolerance in Annual Bluegrass

A number of factors govern heat tolerance in turfgrass plants. This research specifically evaluated what role heat shock proteins play in high temperature tolerance of annual bluegrass and other turfgrass species. Results demonstrated the difference observed at the whole plant level was also present at the cell level.

Heat shock proteins are produced during periods of high temperature stress. Normal protein synthesis shuts down at high temperatures, while heat shock proteins are beginning to synthesize. Their occurrence is ubiquitous in nature, but their role in heat tolerance is not fully known.

Initial screening of numerous annual bluegrass biotypes revealed a 12°C (54°F) difference between the most sensitive and the least sensitive biotypes. In addition, attempts were made to determine the location of the heat shock protein genes within the genomic DNA from turfgrasses.

Pathology

Texas A&M University - Dr. Phillip F. Colbaugh

Developing Rhizoctonia Brown Patch and Pythium Disease Resistance in Bentgrass and Zoysiagrass

The research efforts of this project focused on the development of screening techniques for resistance to brown patch and *Pythium* blight and root rot; assessment of *Pythium* blight and root rot resistance in the bentgrass germplasm and polycross populations; and the evaluation of the National Turfgrass Evaluation Program (NTEP) bentgrasses and zoysiagrasses for resistance to *Pythium* and *Rhizoctonia* blight.

The inheritance of foliar disease resistance appears to be a predictable and stable characteristic based on investigations using crosses of disease resistant bentgrass parental lines. Synthetic polycross populations were tested for resistance to *Pythium* blight. Disease resistant bentgrass progeny were identified after inoculating populations produced from reciprocal crosses of resistant and susceptible bentgrass parental lines. In two inoculation studies, genetic populations from four crossing blocks were more blight resistance than other populations studied.

In addition, a disease heritability analysis was conducted which utilized intercrossed resistant and susceptible parental lines and reciprocal cross

progeny plants obtained from a *Pythium* blight resistant population. The susceptibility of progeny from crosses involving at least one of the resistant parental lines gave an overall mean blight of 6.9 percent, while crosses without a resistant parent resulted in a 14.3 percent mean blight rating. This information will be very useful in determining the segregation of disease resistance in future disease screening research.

A root inoculation procedure was used to screen bentgrass germplasm lines for resistance to *Pythium* root rot. This method was used to screen over 1,550 plants. At present, 123 germplasm lines of bentgrass appear to have some resistance to *Pythium* root rot disease. The surviving population represents about 12% of the total plants screened.

Standard inoculation techniques were used to determine the susceptibility of the National Turfgrass Evaluation (NTEP) bentgrass and zoysiagrass entries to *Rhizoctonia* and *Pythium* blight diseases. In repeated *Rhizoctonia* foliar inoculations, the NTEP bentgrass entry Syn3-88 demonstrated the lowest mean percent blight among the 20 entries tested. Syn3-88, Providence, Penncross and UM8401 were statistically better than National, Forbes and Syn4-88. For the NTEP zoysiagrass trial, the experimental line DALZ 9006 and commercial cultivar Meyer demonstrated a low susceptibility to *Rhizoctonia* foliar blight following inoculation.

Inoculation studies with *Pythium* blight on NTEP bentgrasses demonstrated that Pennlinks, Penncross, National, MSCB-6, Syn3-88 and Cobra were among the most resistant genotypes. Similar inoculation studies with *Pythium* blight on 40 zoysiagrasses demonstrated that germplasm lines TAES3357, TAES3365, TAES3356, TAES3364, TAES3358, DALZ8508 and DALZ8517 were the most resistant among those tested. The relationship of *Rhizoctonia* blight susceptibility and Zoysiagrass leaf blade texture was investigated. In contrast to other grasses, the fine textured zoysiagrass were less susceptible to foliar blight.

Cornell University - Dr. Richard W. Smiley

Resistance of Bentgrass to Leptosphaeria and Phialophora Diseases

Seedlots of 42 bentgrasses from Pennsylvania State University were screened for resistance to two isolates from root-infecting fungi that cause summer patch and necrotic ring spot diseases. The resistance studies were conducted for an 8 week

period in controlled environment growth chambers. Percentages of plants which survived the test were determined and surviving bentgrass plants were returned to the plant breeder.

Methodology also was developed to conduct similar screening studies on vegetatively propagated bentgrasses. This research revealed the potential for further complexities to exist in the etiology of take-all patch of bentgrasses, which was thought at that time to be caused by *Gaeumannomyces graminis* var. *avenae*. In New York, it was demonstrated that *Phialophora graminicola* caused a hot weather form of take-all patch on bentgrasses, and this was confirmed during the development of disease screening methods for this project. These initial findings had relevance to the likelihood that certain disease management strategies would be ineffective during the summer months. Unfortunately, the project was terminated prematurely because the principal investigator moved to another university.

North Carolina State University - Dr. Leon T. Lucas

Spring Dead Spot Disease

The project on spring dead spot of bermudagrass was completed in the fall of 1987. Fungi were isolated from bermudagrass with spring dead spot symptoms throughout this study. Selected isolates of the fungi were used to inoculate bermudagrass in the greenhouse. The inoculated pots were exposed to outside winter conditions during January to May, and spring dead spot symptoms developed with two of the isolates used. The symptoms produced were typical of spring dead spot symptoms on golf course fairways. The fungus that caused the disease was identified as *Gaeumannomyces graminis*, and was the first report of this fungus being associated with spring dead spot of bermudagrass. The fungus was identified on the inoculated plants and from spring dead spot samples collected in May throughout North Carolina and Alabama.

Fungicides and fertilizer treatments were evaluated at four locations in the southeastern United States for the control of spring dead spot. Rubigan applied in September (1 oz. of product per 1000 square feet) and Tersan 1991 (8 oz. of product per 1000 square feet) applied in November were fungicides that gave the best control. Cold hardiness of bermudagrass following treatments with fungicides was evaluated in a study at Raleigh, North Carolina. Plugs of turf that were treated with Tersan 1991 in the fall survived cold

temperatures better than other treatments.

Mississippi State University - Dr. J. V. Krans

Refinement of the Host-Pathogen Interaction System

The Host-Pathogen Interaction System (HPIS) is an *in vitro* cell selection system developed in conjunction with efforts to obtain creeping bentgrass with resistance to *Rhizoctonia solani*. The HPIS is a unique cell selection technique which permits the simultaneous transfer of various substances from a disease organism to a callus culture during concurrent growth, yet which avoids direct physical contact between the organisms. The assembly and application of HPIS evolved through a series of experiments dating back to 1988.

Isolates from the USGA culture collection of *Rhizoctonia* spp. (courtesy of Dr. Phil Colbaugh, Texas A&M University), were co-cultured (concurrently grown) with creeping bentgrass callus in the HPIS. The pathogenic isolates inhibited callus growth and development, whereas the non-pathogenic isolates had no effect on callus viability. Studies were conducted to determine effects of various tissue culture media on vigor and pathogenicity of *R. solani*, primarily hormones and energy source concentrations. Various HPIS cultural studies were conducted, focusing on the length of incubation, duration of concurrent growth-interactions, establishing cultural practices for calli following co-culturing in the HPIS, and examining the persistence of toxicity within the HPIS plates.

Some important questions pertaining to HPIS protocol were answered by these refinement studies: 1) pathogenicity at the whole plant level is similar to pathogenicity at the cellular level; 2) media components, especially growth hormones and energy sources, play an important role in the pathogenic expression of *R. solani* in the HPIS; and 3) the use of HPIS can be maximized with successive co-cultures.

Recent research efforts have focused on using HPIS to obtain creeping bentgrass germplasm with enhanced resistance to *Rhizoctonia solani*, as well as developing an *in vitro* screening technique to verify enhanced resistance at the plantlet level.

Two co-culture procedures, simultaneous and delayed, were evaluated for obtaining bentgrass callus with resistance to *R. solani*. The simultaneous co-culture procedure was designed to allow the callus a gradual exposure to the toxic substances of *R. solani* over a period of 10 days, whereas the delayed co-culture procedure exposed