A PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

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TURF DISEASE MANAGEMENT

Remote diagnostics in turfgrass

By Dr. Ed A. Brown

An education project at the University of Georgia, College of Agricultural and Environmental Sciences is using technology to save turf managers and agricultural producers millions of dollars from damage and crop loss by providing a more efficient and effective mechanism for plant problem diagnostics.

The Distance Diagnostics through Digital Imaging Project, a joint venture implemented by the College's Plant Pathology Department & Office of Information Technology, developed a Internet based program and equipped county Extension faculty in Georgia with computers, digital cameras, and microscopes and trains these faculty to use these tools in assessing factors leading to crop losses due to plant disease and pest infestations.

920 turf samples

Each year, Georgia turf managers and farmers through county Extension faculty submit more than 3,000 plant problem samples to the Plant Pathology Plant Disease Clinics for diagnosis. Of those, 920 were turfgrass samples in 2000. Traditionally, plant samples are mailed or hand-delivered for analysis.

Distance Diagnostics through Digital Imaging saved Georgia growers over $17.7 million.

The samples are catalogued and examined by plant pathologists, who then communicate back the diagnosis and educational recommendations to the county Extension office. This process typically could take from two to four days. A large number of the samples are destroyed or deteriorate en-route, making an accurate diagnosis sometimes difficult.

Computer equipment was provided by the private foundation -funded project. Extension county faculty at these agricultural imaging stations can take digital images of the diseased or pest-infested plant sample, and transmit those images along with grower information through the Internet to UGA scientists who can make an assessment and recommend treatment in a timely manner.

The decrease in diagnostic turnaround time alone potentially saves millions of dollars for Georgia agriculture. Turfgrass diseases on fine turf can cause damage in a short period of time and an expedient diagnosis can be the difference between success and failure. At the time of discovery, early detection and confirmation of a turf disease or pest infestation can be localized.

With the traditional turnaround time of three or four days, plant disease can spread quickly. Treatment may have escalated to a curative chemical remedy sprayed over a large area. This new program not only saves money and time to turf managers, but also has a positive environmental effect as a result. This is "prescription agriculture," diagnosing the problem so a control manage-

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ment program can be targeted to the precise situation.

In 2000, crop disease loss cost Georgia agriculture more than $654 million, or about 20 percent of the $3.25 billion total crop value. A survey was conducted in 1999 and during the first two years of implementation Distance Diagnostics through Digital Imaging saved Georgia growers over $17.7 million. The success is attributed to the quick diagnostic turnaround and timely implementation of control practices.

The Project represents a crosscutting initiative between Extension Plant Pathology and the Office of Information Technology. This project achieves several objectives. The positive impact it has on the agriculture economy of the state is quite evident. But other substantial benefits include the building of a plant disease database accessible over the Internet and the use of this data in the education of growers and instruction of our students at the University of Georgia.

County faculty use a digital camera and a dissecting microscope to take images of affected plants. They also use a compound microscope, which can magnify images up to 600-1000x their original size. These images are then uploaded via a standard World Wide Web browser to a database along with notes about the situation and information based on the grower's observations.

Over 600 samples consisting of over 1,800 images are submitted annually for disease diagnosis through the system. The college is using these images and data to develop a disease image library accessible over the Internet. A number of the best images are currently online now for use by students, professors and researchers making them more familiar with plant disease recognition. As samples are received, the library will be expanded.

Project funding

The project, funded by a three-year private gift from an Atlanta-based foundation and matching funds from the Georgia state lottery for an investment of more than $1 million, not only equipped 94 College of Agricultural and Environmental Sciences county Extension offices across the state, but also supported training faculty in all county offices on the techniques and benefits of Distance Diagnostics.

Images are uploaded via a standard World Wide Web browser to a database along with notes about the situation and grower observations.

The project goal is to produce an Internet Imaging System that is easy to use, supportable, facilitates diagnostics, and is easily replicated.

The success of implementing the project is based on several factors. First, the project coordinators, through extensive development and testing, ensured that the system worked and that images were usable. That is the key to giving the scientist accurate samples from which to make a diagnosis. It was also important that the digital library have the best possible images from the field that could be provided. To do so, it was ensured that the hardware, software, and database interfaces were sound. Then a systematic plan was developed to train College academic and county faculty. There is an online tutorial on using the equipment available on the College's Distance Diagnostics project Website.

The right equipment

The hand held digital camera can take images of field problems and give the diagnostic faculty a feel of the problem in the field. This component is often not available when a physical sample is submitted to the Plant Disease Clinic. The stereoscope is used for observing insects, weed identification characteristics and can be used to image these characteristics for sample submission. The compound microscope is essential to magnify fungus spores and fruiting bodies for an accurate disease diagnosis because some symptoms are common to many different diseases.

An important aspect of the project is the collaboration of different disciplines to develop a low-cost, reliable product that proves to be a tremendous economic asset to Georgia's agriculture economy and also an effective tool for teaching our plant growers and students diagnostic techniques.

Many disciplines at the University of Georgia have been incorporated into this program. They include Plant Pathology, Entomology, Crop & Soil Sciences (weed identification, water problem evaluation, general crop problem determination), Horticulture, Aquaculture (Forestry), Agricultural and Biological Engineering and the College of Veterinary Medicine.

Other state contracts

The scope of the project is not limited to Georgia agriculture applications. Illinois, Louisiana, Alabama and Texas have contracted with Georgia to customize programs for their Cooperative Extension Systems. University faculty at those states Land Grant Universities are diagnosing problems submitted through their Distance Diagnostic programs developed by the University of Georgia. Inquires from six New England States (Massachusetts, Maine, Connecticut, New Hampshire, Vermont, and Rhode Island) and other states have been made. Private industry and agriculturalists doing research in other countries have also expressed interest.

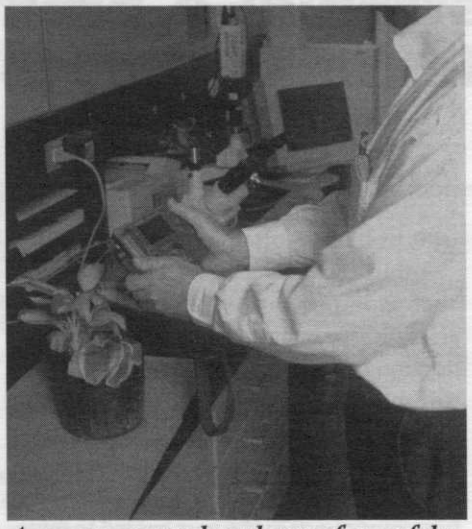
Distance Diagnostics will not completely replace the submission of physical samples for evaluation, but could replace about 60 percent of physical samples diagnosed in the Georgia Plant Disease Clinic by simple compound microscopic examination.

For more information about Distance Diagnostics Through Digital Imaging, visit the project website at *www.dddi.org*.

The system does not support individuals submitting images for evaluation and diagnosis. For the same reason that there are Medical Imaging Centers, it takes trained, technical support to process the samples correctly for the highest quality images for diagnostic purposes. The Cooperative Extension Service is the Land Grant affiliated system that is responsible for diagnostic education in most states and is a key component in the states that are participating in the program.

Tool box for diagnostics

The Distance Diagnostics Team is developing a Tool Box for the Distance Diagnostics through Digital Imaging System. This toolbox will be marketed to consultants to provide them with a system for them to use to receive images from their clients.



A county agent takes photos of one of the 920 turf samples submitted each year by Georgia turf managers. In all, extension faculty submit more than 3,000 plant problem samples to the Plant Pathology Plant Disease Clinics for diagnosis.

Another related project that is being developed and is in Beta testing is a wireless system to compliment Distance Diagnostics through Digital Imaging. Samples of images can be submitted from the field using a lap top computer and the accompanying mini microscopes. The data is submitted using a wireless packet data digital phone.

Both these projects support LG Media, which is being developed to store images of faculty as an archival system. These images will be available to the general public as well as used by research and teaching faculty.

The Internet Imaging System at the University of Georgia supports the development and maintenance of the above databases and Internet based systems. These programs use the technology available to support the grass roots diagnostic and educational programs that are the foundation of a successful agricultural plant production program.

Dr. Edward A. Brown is professor of plant pathology (retired) at the University of Georgia. He received his BS in general agriculture, his MS and his Ph.D. in plant pathology, all from the University of Georgia.

This is "prescription agriculture," diagnosing the problem so a control management program can be targeted to the precise situation.