

# Distance Diagnosis through Digital Imaging

by Darrell Hensley and Alan Windham  
Entomology and Plant Pathology Department  
University of Tennessee Extension Service

## Introduction

The *Distance Diagnosis through Digital Imaging System* at the University of Tennessee Extension Service will allow text based information and digital images to be submitted from county Extension offices for rapid diagnosis by resource professionals at the Plant and Pest Diagnostic Center, in Nashville. Extension field personnel are trained to submit plant disease or pest images and information using digital cameras, microscopes, computers and the internet. The system uses conventional software and hardware proven to be effective and reliable.

Imaging stations have been distributed geographically in county Extension offices across Tennessee. Additional stations will be placed in other counties as funding becomes available. *Distance Diagnosis* will reduce diagnostic turn-around time from an average of four days to one day when compared to sending physical specimens through postal mail. Digital images of plant disease, insect and weed pests can be uploaded to the *Distance Diagnosis* web page and diagnosed within one hour in emergency situations. Diagnostic responses will be provided on the internet, or by phone, FAX or email.

## Project Benefits

- Agribusiness enterprises that depend on timely pest identification, save money as they are able to respond quickly to emerging disease, insect or weed outbreaks.
- County Extension agents will strengthen their diagnostic skills and become more valuable resources in their communities.
- A library of images is currently being constructed and will serve as a crop pest profile reference library. This will be available as an educational resource for Extension agents, undergraduate and graduate students, farmers, nursery workers, landscapers, golf course superintendents, pest management professionals and master gardeners.
- *Distance Diagnosis* utilizes the expertise of faculty located across the state. These faculty members work with various disciplines and their expertise helps improve accuracy and efficiency of diagnostic responses.

Special arrangements will be required for individuals, consultants or commercial organizations requesting disease diagnosis or pest identification on large numbers of samples. Charges will need to be determined in advance of these submissions.

For more information concerning this program contact: [dhensley@utk.edu](mailto:dhensley@utk.edu) or [awindham@ext1.ag.utk.edu](mailto:awindham@ext1.ag.utk.edu)

# Guidelines for Submitting Plant Disease, Insect and Weed Specimens Using Distance Diagnostics Through the Digital Imaging System

by Darrell Hensley and Alan Windham  
Entomology and Plant Pathology Department  
University of Tennessee Extension Service

The Distance Diagnostics Project was designed to rapidly transmit images of pest problems and related information to the Soil, Plant and Pest Center located in Nashville, Tennessee. The objective of this system is to improve the diagnostic response time, therefore improving crop sustainability while promoting best management and integrated pest management practices for clientele in Tennessee. This project enhancement was initiated due to the nature of insects, plant diseases and weeds which have the ability to rapidly multiply and where immediate control is essential in order to reduce economic losses. Distance Diagnostics enhances the Soil, Plant and Pest Center's system in which samples are sent via mail. By using web based imaging and informational text format, specimens can be rapidly diagnosed. This system will also provide a pest imaging library which can be used for research and teaching.

## General Responsibilities for Everyone Using Distance Diagnostics:

**Submitting Images** - Specimen images submitted using this system will be accepted only when received through county extension offices and other designated distance diagnostic locations such as Jackson, Nashville and Knoxville. Also, by sending images through the county extension office, county personnel will become more familiar with county clientele and specific pest problems which occur in the county. In addition, uploading images and forms only from selected points will help reduce possible virus infection of the system.

The Entomology and Plant Pathology Department will train county extension personnel on the diagnostic characteristics that are important in identification of arthropod and disease pests. The Plant and Soil Science Section will inform extension personnel of proper photographic procedures for weed identification and in cases where herbicide injury is suspected.

**Login ID and Password** - **Do not** share your login ID or password. Due to the constant threat of computer virus invasion, passwords and login IDs **should not be** freely distributed among assigned users of the Distance Diagnostics System.

**Uploading Images** - For security purposes and management of uploaded images, only **upload** images in the "JPG" format. JPG formatted images are compressed and generally take less time to upload than most other graphic formats.

**Viewing Images** -- **Do not** attempt to view any attached image unless in "JPG" format. This will help reduce the possibility of getting a virus which may be attached to other file formats.

**Diagnostic Forms** - Fill out diagnostic forms as completely as possible. The more information the diagnostician has, the more reliable the diagnosis will be.

**Digital Cameras** - If using cameras with fine or high resolution (greater than 640x480 pixels), you may want to use a graphic software package to save the image at 500x700 pixels to help reduce uploading time. This will help reduce your online charges.

**Procedure Before Uploading** - Please view all images prior to uploading. Do not send multiple copies or exact duplicates of the image. Use your judgement and get several photos of the subject at different angles. In many cases, a close up and wide angle shot makes diagnosis easier. Make certain that the image is in focus and that the contrast is correct.

**File Names** - When assigning a name to a file, make the file name generic. The suspected problem may not be the true culprit and specific file names, such as "graymold" may confuse individuals who view the guest library or other crop profile libraries. File names such as MVC001.jpg or soybean1.jpg may be less confusing.

## **Current and Future Passwords for Extension Agents**

Currently, county extension offices have been assigned passwords for this system which are identical to passwords and login IDs used by the soil lab. Login IDs and passwords associated with the soil lab will be discontinued when county offices have the ability to access the Lotus Notes email system.

Soon we will be able to send images via the Distance Diagnostics System using the same login ID and password as used in the Lotus Notes email system. Since the passwords and login IDs are personal, the likelihood of distributing (sharing) the password will be reduced and hopefully reduce the risk of virus infection of the Distance Diagnostics System. Also, by using this password system, we will eventually be able to determine areas in which an individual may be weak in identification. With this information, training sessions can be developed to address areas of weakness.

## **Education and Teaching Objectives**

Only representative images will be placed into an agricultural and horticultural crop database which will be searchable by crop. Descriptions and diagnostic characteristics will be included within this database. By having images and text within a database, extension agents and the public will become more knowledgeable of pest problems.

## **Responsibilities of the Diagnostician**

The Diagnostician and/or Specialists located in Nashville will be responsible for diagnosis of images and information uploaded into the distance diagnostic system.

- 1) Only attached files with a "JPG" file extension will be viewed. Do not view any files with extensions ending in "exe", "bat", "dll", "ovl" or word processor extensions. Other file extensions could harbor viruses. Delete all attached images other than "JPG."
- 2) Diagnosis and controls will be coordinated by Nashville specialists and/or staff. Plant identification, analysis of herbicide injury and recommended control measures will be coordinated by Plant and Soil Science Staff in Nashville and Knoxville.
- 3) Specialists and staff located in Nashville on occasion may contact other specialists in the E&PP Department or other University faculty and/or staff for further identification, diagnosis and recommended controls.
- 4) If agents have not marked the form for "Guest Access," the Nashville site may mark the image(s), so they may be viewed by other specialists.
- 5) After diagnosis has been made, the person responsible for making the diagnosis should include their name in the diagnosis section of the form.

**E&PP and P&SS Specialists in Nashville**

- Do not open attached files ending in file formats other than "JPG".
- Delete attached images ending in file formats other than "JPG".
- Make diagnosis and recommended controls as soon as possible. The name of the person making the diagnosis and controls should also be listed on the form. Specialists are encouraged to refer to URL's of factsheets published by the Tennessee Extension Service. When uploading an image for the library, please include the county where the specimen was obtained and not the county where your office is located.

**E&PP and P&SS Specialists in other Locations**

- Make diagnosis and recommended controls when contacted by the Diagnostician and/or Specialists located in Nashville.
- The diagnosis area on the form should contain "the diagnosis, control recommendations and the name of the specialist who made the diagnosis and controls."
- When uploading an image for the library, please include the county where the specimen was obtained.

**Responsibilities of County Extension Agents, Area Specialists and Other Personnel**

- Do not share the county or your personal login ID or password with other county offices or the public. This will aid in security of the main computer system and reduce possible computer virus corruption.
- Upload digital images which are in "JPG" format only. Other uploaded image formats will be deleted.
- Please fill out the diagnostic form as completely as possible. The form has several areas in which information is required. This will assist agents as well as the laboratory in tracking pest problems and, on occasion, making management recommendations.
- When making photographs, it is recommended that the photographer obtain a good overall picture of the pest problem, such as a photo of the affected portion of the field. This should be followed by representative photos of single plants or leaves or the entire insect. It may be necessary to use the stereo microscope or compound scope to capture closeup images to identify many insects, plant diseases and/or weeds.
- If information is needed by a specialist outside the Entomology and Plant Pathology Department, information contained on the diagnostic form can be sent via email to individuals by selecting within your browser (Netscape or MS-Explorer) "File" in the upper left hand portion of your screen. Then select "Send document" or "email file". This will email the completed diagnostic form to the address you select. If the person receiving the document has web access, they may view the associated image file by logging into the distance diagnostics system as a guest. However, you will need to inform the specialist of the name of the particular image file of interest. The diagnostician and/or specialists located in Nashville may also contact others outside the distance diagnostics system for further assistance.
- If the extension agent wants their county clientele to view an image, they may do so by logging in as a guest (the login ID is "guest", the password "guest4pest").

## **Guests**

Guest may view any image marked by Agents or Specialists as "Guest View"

Guest login = guest

Guest password = guest4pest

## **The Distance Diagnostics System is a Limited Access Database**

There are several reasons for limited access to the system. The primary purpose for limited access is due to threat of a virus. Also, in many cases leaving the system open for the general public and others may result in confusion concerning disease and insect identification. In addition, the random use of file names of images not associated with the true cause may result in future mis-identification by the general public. Such an event previously occurred with an image file containing an extension of JPG. As the database of images increases, specialists can take representative images of pest problems and develop a crop pest database.

## **Future improvements for the distance diagnostics project**

In emergency diagnostic matters, county personnel are advised to contact the Soil, Plant and Pest Center located in Nashville at (615) 832-6802. Suggestions for additions, changes and/or improvement of the Distance Diagnostics Project should be directed to Darrell Hensley ([dhensley@utk.edu](mailto:dhensley@utk.edu)) 865-974-7138 or to Dr. Alan Windham at the diagnostic lab.

## **WEED SPECIMENS**

If either "weed" and/or "suspect herbicide injury" is selected, the Plant & Soil Science Section will have access to specimens marked in this manner. Dr. Neil Rhodes indicated that samples marked herbicide injury would be reviewed by Dr. Darren Robinson or Dr. Neil Rhodes and images for weed identification would be reviewed by Dr. Darren Robinson or other members of the Plant and Soil Science Section.

More information and the link to Extension Agents specimen submission page can be found on the Entomology and Plant Pathology Departmental web page located at: <http://web.utk.edu/~extepp/diagnost.htm>

Information about the Soil, Plant and Pest Center can be found at: <http://soilplantandpest.utk.edu/>

## Instructions for Collecting, Preparing and Mailing Specimens:

1. GIVE COMPLETE INFORMATION on form. See F654, "Insect and Plant Disease Information Sheet," for more information.

<http://soilplantandpest.utk.edu/forms/insectplantinfo.pdf>

Note that there is a charge to send in physical specimens (there is currently no charge to use the distance diagnostics system). The fee information is listed on the current form. You may pay online with a credit card at: <https://web.dii.utk.edu/agstore/>

2. SEND GENEROUS AMOUNTS of material; ENCLOSE plant material IN PLASTIC BAGS; NEVER ADD WATER to any sample; NEVER mix several host species in a single bag; AVOID LOOSE SOIL.

3. SEND specimens IMMEDIATELY after collecting. If holdover periods are encountered, keep specimen cold. Mail packages to arrive on weekdays (Monday through Friday) rather than during weekend.

4. Protect specimens from being crushed in the mail. Place insects in a vial of alcohol and send in a mailing tube.

5. If general decline or dying of plants is observed, send WHOLE PLANTS showing EARLY SYMPTOMS, with roots and adjacent soil intact. DIG UP CAREFULLY. If a field crop, send several plants. DEAD PLANTS ARE USELESS for examination.

6. When not possible to send whole plants, always send generous samples of above-ground portions (showing early symptoms), at least a PINT of SOIL, and a good handful of FEEDER ROOTS. This especially applies to large ornamentals, shrubbery, evergreens and small trees. Be sure to enclose all materials in plastic bags.

7. When localized infections, such as cankers, leaf spots and rots, are involved, send specimens representing early and moderate stages of disease. For cankers, include healthy portions from above and below disease area.

8. DEAD PLANTS, material that is DRY or DECOMPOSING on arrival and specimens arriving WITHOUT NECESSARY INFORMATION CANNOT BE DIAGNOSED.

9. Specimens should be mailed to:

Soil, Plant and Pest Center  
5201 Marchant Drive  
Nashville, TN 37211-5112

**NOTE:**

For deliveries other than USPS use same address, but change zip code to **37220**

General Information about the Soil, Plant and Pest Center, including Soil testing and Forage and Grain analysis forms and fee information can be found on the web located at: <http://soilplantandpest.utk.edu/>