Martin-Gatton
College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-GEN-09**

Submitting Plant Specimens for Disease Diagnosis

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Introduction

Commercial and residential growers encountering plant disease problems may not always be able to answer the "what is wrong with my plant?" question on their own. For those times, the assistance of a local county Extension agent may be necessary. For challenging diagnoses, agents may consult with the University of Kentucky Plant Disease Diagnostic Laboratory (PDDL). This publication is designed to help growers, consultants, and Extension personnel provide suitable plant samples and information for accurate diagnoses. The information on preparing samples for shipment to PDDL is directed to staff in Cooperative Extension Service (CES) offices.

Gathering Information

Information about the plant, planting site, and symptoms can be as important as the physical plant material collected. When collecting a sample, be prepared to supply the following information as it pertains to your situation.

- ***What type of plant is affected?*** Identify the plant by its common name (and scientific name, if known) and cultivar. If the plant's identity is unknown, submitting a healthy plant (or picture of a healthy plant) for comparison may be helpful.

- ***What is the age of the plant or planting date?*** Be as specific as possible with annual crops. A general time frame (e.g., month and year) is often sufficient for trees, shrubs, and perennials. Indicate whether the tree/shrub has been recently transplanted (less than a year) or is well-established.

- ***What has been done to care for the crop/plant?*** Include information on tillage, irrigation, mulches, and other cultural practices. For annual crops, provide site history and previous crops. Fertilizer and pesticide application dates and rates should also be noted.

- ***Has disease been a problem at this site?*** Provide information on previous diagnoses or other plant losses.

- ***What are the symptoms? What parts of the plant are affected?*** Take time to examine the entire plant and determine the specific location (buds, leaves, fruit, stems, etc.) and pattern (young vs. older leaves, one side of plant) of symptoms. If only part of a plant can be collected, such as detached leaves or branches, describe

any symptoms observed on other portions of the plant. Note anything unusual that may not be visible on the physical sample and submit supplemental photos of the planting if possible. Check tree trunks for wounds or for mechanical injuries; describe appearance and location. Indicate whether there are any mushrooms or other fungal fruiting bodies associated with tree trunk or surface roots. Take note of similar symptoms on nearby plants such as adjacent landscape plants.

- ***When did symptoms first become evident?*** Indicate whether symptoms appeared suddenly or gradually. Document progression and patterns.

- ***What external factors may have affected the crop?*** This can include such things as weather events (drought, flood, hail, lightning, frost), site disturbances (nearby construction, utility work), physical injury (mower or string trimmer damage), or animal activity (wild or domestic).

- ***What is the production system?*** Describe whether plants are in a field, float bed, greenhouse, high tunnel, landscape, orchard, vegetable garden, etc.

- ***Do you detect any patterns?*** Pay particular attention to low wet areas, dry slopes, field borders, and shaded areas. Note whether problems are a single plant showing symptoms or are scattered plants, group(s) of plants, or the entire planting affected. Indicate which plant types or cultivars are affected.

Collecting Samples

A fresh, representative sample is critical for diagnosis. Follow these general guidelines:

- ***Collect whole plant samples*** when possible, including roots.

- ***Always dig plants*** to keep root systems intact and soil in place around the roots. Small roots are often needed for diagnosis, and they may be left behind if plants are pulled rather than dug.

- ***Choose several plants showing a range of symptoms***, especially those in the early stages of the problem. Diagnosis will not be possible on dead plant material alone.

- ***Include pictures*** of the problem (overview and close-ups), along with those of the surrounding area, whenever possible.

- ***Do not expose samples to extreme heat or cold*** (such as leaving them inside a vehicle on a sunny day). Collect samples early in the week to avoid holding them over the weekend.

- ***Keep samples dry.*** Never add moisture to samples; spritzing with water or adding wet paper towels hastens decay and encourages the growth of secondary organisms. Soil and rootballs should be bagged in plastic, but leaves, fruit, and woody material should be wrapped in paper.

Submitting a Sample

Growers and consultants should deliver samples to a local CES office as soon after collection as possible. In many cases, the local Extension agent can diagnose the problem on site. If samples need to be forwarded to the PDDL, staff at the CES office will facilitate shipping. Growers should not mail samples directly to the Plant Disease Diagnostic Laboratory.

Once at the CES office, you will be asked questions to help complete a PDDL form. For tree/shrub samples or greenhouse/high tunnel production, an additional form is needed. The information you have collected (see Gathering Information section above) will be invaluable in completing these forms.

Packaging Samples for Mailing

(for County Extension Service staff use)

Extension office personnel should package samples following these general guidelines:

- ***Mail samples early in the week*** whenever possible using the quickest shipping option possible. Samples sitting at the shipper's office for several days or over the weekend may deteriorate and arrive in poor condition.

- ***Cushion fragile samples*** with newspaper and ship in a sturdy box.

- ***Wrap roots and soil in plastic bags*** to protect leaves from becoming contaminated with soil.

- ***Never add moisture*** to plastic bags containing samples. Spritzing the sample with water or adding wet paper towels hastens decay and encourages the growth of secondary organisms.

- ***Clearly label samples***, especially when multiple samples are shipped in the same box. Include a separate diagnostic form for each different sample.

- ***Protect forms and photos*** by placing them in an envelope or plastic bag separate from the sample material.

Specific Instructions

Refer to Table 1, below, for specific instructions on how to collect and package various types of plant samples. Growers should contact their CES office if they have questions regarding the best type of sample to submit. Remember that delays in diagnosis occur when improperly collected and/or packaged samples are submitted for diagnosis.

Table 1. Information on collecting plant samples for diagnosis, along with packaging instructions for specimens shipped to the Plant Disease Diagnostic Laboratory.

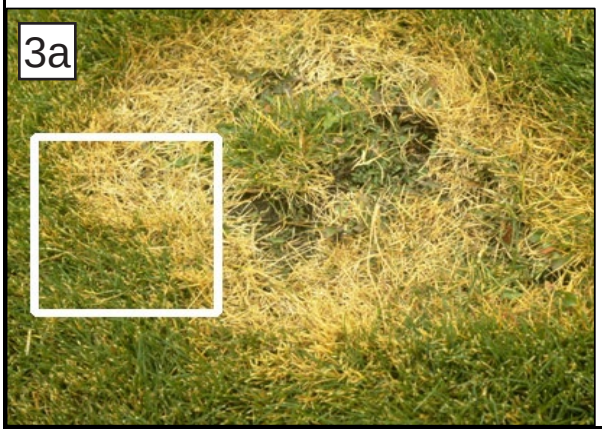
Collection Instructions	Packaging for Shipping
Whole Plants *(Field & row crops, garden plants, herbaceous ornamentals, trees, shrubs, container-grown plants)*	
General	
• Select plants showing various stages of the problem, including early stages of disease development. Include healthy plants for comparison if possible. • Carefully dig up in-ground plants to include soil and fragile feeder roots (1a). Never pull up plants. • Leave container plants in their pots (1b), cells, or flat.	• Secure root ball in a plastic bag (1c & 1d) so that foliage remains dry and soil-free; tie off bag at plant stem. • Ship container plants either by enclosing pot with plant in a plastic bag (1b) or removing plant from the pot and enclosing rootball in a plastic bag. In both cases, tie off at stem. • Bend or cut large plants into sections for shipping. • Use shipping materials that will best protect the sample(s), either a sturdy box (1e) or padded envelope. Add filler, such as crumpled paper, to prevent shifting and to cushion samples.

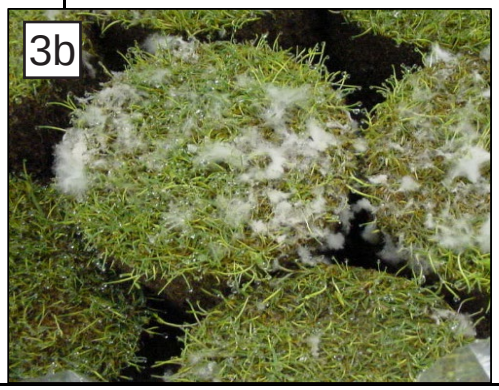
Table 1. *(cont'd)* Information on collecting plant samples for diagnosis, along with packaging instructions for specimens shipped to the Plant Disease Diagnostic Laboratory.

Collection Instructions	Packaging for Shipping
Whole Plants *(Field & row crops, garden plants, herbaceous ornamentals, trees, shrubs, container-grown plants)*	
Seedlings	
• Seedlings are fragile and can deteriorate quickly. • *In ground:* Carefully dig up at least 10 to 12 seedlings showing various stages of decline. Do not damage roots and leaves during collection. • *In cells/flats:* Leave seedlings in growing containers (2a). • Leave soil attached to seedling roots (2b).	• Seedlings are fragile and require careful packaging. • Soil around seedling roots should be moist but not saturated. • For larger seedlings, package as per whole plants. Tiny seedlings may need to be packaged individually. • Use a sturdy box for shipping. • Add filler, such as crumpled paper, to prevent shifting and to cushion samples.
Grasses & Small Grains	
• Dig (include roots) turfgrasses and pasture grasses at the margin of the problem area (3a). • Include both healthy and symptomatic plants (3b). • Never pull up plants.	• Pack turfgrass samples with dry newspaper to hold plants and soil intact. • Secure rootball of pasture grasses in a plastic bag and tie off so that foliage remains soil-free (3c). • Tops of tall grasses or grains may be bent for shipping. • Use shipping materials that will best protect the sample(s), either a sturdy box or padded envelope. Add filler, such as crumpled paper, to prevent shifting and to cushion samples.


2a


2b

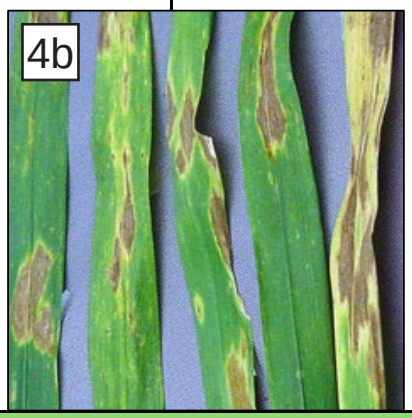

3a


3b


3c

Table 1 *(cont'd)*. Information on collecting plant samples for diagnosis, along with packaging instructions for specimens shipped to the Plant Disease Diagnostic Laboratory.

Collection Instructions	Packaging for Shipping
Leaves Only *(Only when a - leaf spot disease is suspected)*	
• Collect multiple leaves that best represent the problem and show a progression of symptoms (4a & 4b) • Label leaves to identify where on the plant they were collected (e.g., upper, middle or lower; oldest or newest leaves). • Because stem or root disease may be the cause of leaf symptoms, consider examining and sampling additional tissues.	• Layer individual leaves between dry newspaper or other paper (4c). • Place loosely in a paper bag. Avoid using plastic bags. • Place sample in padded envelope or cardboard mailer.
Woody Material *(Ornamental & fruit trees & shrubs; in-ground or container-grown)*	
Twigs & Branches	
• Follow diseased branches back until healthy tissue is located; collect several inches below the diseased portion (5a). • Include branches with cankers, if present. Cankers may be appear as discolored lesions (5b) or cracked, sunken areas (5c). • Take photos of the whole plant, plus close-ups.	• Large specimens can be cut into smaller sections. • Wrap in dry newspaper (5d) • Place sample in padded envelope or sturdy box. • Add filler, such as crumpled paper, to prevent shifting.



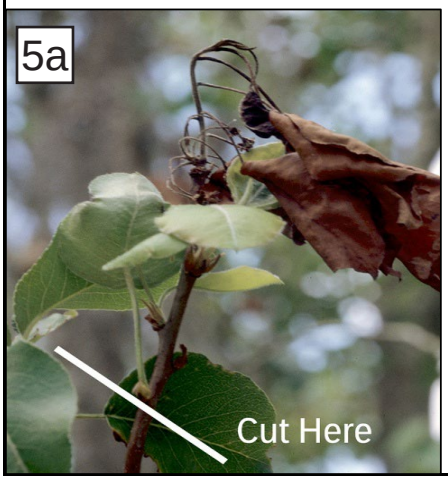


Table 1. *(cont'd)* Information on collecting plant samples for diagnosis, along with packaging instructions for specimens shipped to the Plant Disease Diagnostic Laboratory.

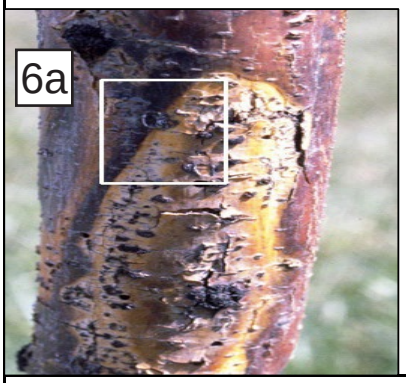
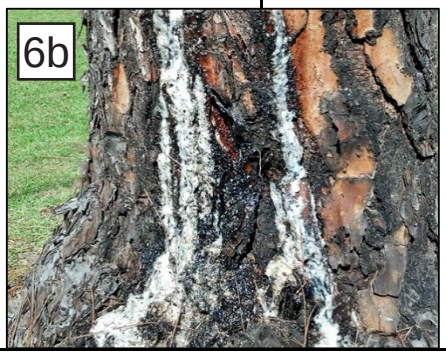
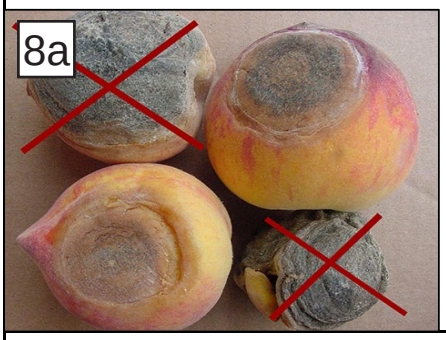
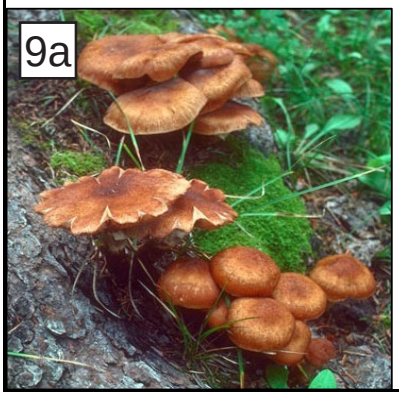
Collection Instructions	Packaging for Shipping
Woody Material *(Ornamental & fruit trees & shrubs; in-ground or container-grown)*	
Trunk	
• Look for cankers (6a), wounds, or oozing areas (6b). • Cut small pieces of bark and wood from the outer margin of cankers or diseased areas (6a); sample should include living and diseased tissue. • Cut circular sections of the trunk if tree is to be removed (6c). • Take photos of the whole plant, plus close-ups.	• Wrap in dry newspaper. • Place sample in padded envelope or sturdy box.
 	
Roots	
• When the entire plant cannot be collected, root samples may be submitted along with upper plant parts. • Carefully remove (7a) or dig up segments of roots (7b) from affected tree or shrub. • If entire tree or shrub is to be removed, collect the whole root ball with the collar (base of stem) attached (7c). • Take photos of the whole plant, plus close-ups.	• Place root samples with surrounding soil in a plastic bag (7b). • For root balls with main stem/trunk, enclose root ball along with any attached soil in a plastic bag and tie off at the stem (7c). • Place samples in a sturdy box (preferred) or padded envelope, depending on sample size.
 	

Table 1. *(cont'd)* Information on collecting plant samples for diagnosis, along with packaging instructions for specimens shipped to the Plant Disease Diagnostic Laboratory.

Collection Instructions	Packaging for Shipping
Fruit & Fruiting Vegetables* *(Tree fruit, small fruit, nuts, vegetables & tubers)*	
• Select fruits and vegetables showing the earliest signs of decay. • Do not submit severely decayed material, which may deteriorate rapidly and not be useful (8a).	• Carefully dry samples so they are free of surface moisture. • Avoid severely decayed material that will not ship well. • Wrap carefully in dry newspaper (8b). • If needed, place wrapped specimen in a plastic bag to avoid leaking (8c). • Place samples in a sturdy box.
Mushrooms for Identification* *(Mushrooms, conks)*	
• Select mushrooms at different stages of maturity (9a). • Dig up specimens to include below-ground structures (9b). • Cut conks (bracket fungi) away from host (9c). • Take pictures of their growth pattern and growing site.	• Carefully dry samples so they are free of surface moisture. • Wrap carefully in dry newspaper. • If needed, place paper-wrapped specimen in a plastic bag to prevent leakage. • Place samples in a sturdy box.





*****These samples tend to be fragile and decay rapidly. Take extra care in collecting, packaging, and shipping.*

Additional Resources

Additional information can be found on the UK Plant Pathology Extension Publications webpage https://plantpathology.mgcafe.uky.edu/extension

- Canker Sampling of Trees and Woody Ornamentals (PPFS-OR-W-27)
- Diagnosis of "No Disease" (PPFS-GEN-11)
- Diagnosis of Ornamentals in the Landscape (PPFS-GEN-15)
- Diagnosis of Vegetable Diseases in Production (PPFS-VG-13)
- KY Master Gardener Manual: Diagnosing Plant Problems (Chapter 7) (ID-194)
- Submitting Turfgrass Samples for Disease Diagnosis (PPFS-OR-T-14)

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Photos: University of Kentucky—William Nesmith (1a, 2a), Sara Long (1c, 1e, 3c, 4c, 8b, page 1), Julie Beale (1d, 5d, 6c, 8c), Kenneth Seebold (2b), Paul Bachi (3b, 4b, 8a), Cheryl Kaiser (5c), Nicole Gauthier (7a); Bugwood.org—Mary Ann Hansen, Virgiana Tech (1b), William Brown (3a), Sandra Jensen, Cornell University (4a), Florida Division of Pant Industry, Florida Department of Agriculture and Consumer Services (5a, 7c), Theodore D. Leininger, USDA Forestry Service (5b), William Jocobi, Colorado State University (6a), Joseph LaForest, University of Georgia (6b), Dave Powell, USDA Forest Service (retired)(9a), David Stephens (9b), USDA Forest Service - Northern and Intermountain Region, USDA Forest Service (9c); North Carolina Department of Agriculture (7b)

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