

PLANT DISEASE DIAGNOSTIC LABORATORY

PROCEDURES MANUAL FOR COUNTY AGENTS AND STAFF ASSISTANTS



Revised February, 2014

Plant Disease Diagnostic Laboratory: Procedures Manual for County Agents and Staff Assistants

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University of Kentucky Plant Disease Diagnostic Laboratory General Information

➤ **Location of Laboratories**

The Plant Disease Diagnostic Laboratory (PDDL) is part of the Department of Plant Pathology at the University of Kentucky. The Lexington facility is located at the end of the greenhouse complex which is behind the Agricultural Science Center-North. The facility in western Kentucky is located in the main building at the UK Research and Education Center in Princeton. Counties are assigned to one of the two laboratories for sample submission. Refer to the map on page 32 ([appendix](#)).

➤ **Purpose:**

To confirm diagnoses made by agents and help to diagnose difficult/complex disease problems. The main purpose of the Laboratory is to act as a back-up to County Extension Agents and Extension Specialists by confirming their diagnoses and assisting in the diagnosis of their clients' more difficult or complex disease problems. Our Laboratories are equipped to perform a number of special tests which can be used to confirm a diagnosis. In addition, we consult with the Extension Specialists in Plant & Soil sciences, Entomology and Horticulture when necessary.

To train agents to recognize common disease problems.

The Laboratories also help train County Extension Agents to recognize the more common and obvious disease problems. Whenever possible, Agents who come to the Laboratories with samples are advised on key diagnostic symptoms which will allow them to identify the same problem on their own. For other Agents, this learning process takes place after receiving the diagnostic report. For more training opportunities, see page 14.

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Submitting Plant Samples

➤ Plant Disease Identification Form

ATTENTION

We will no longer be printing the three-part PDDL forms as we have in the past. The revised Plant Disease Identification Form can be found and printed from the [appendix](#) of this document (page 29). Please be sure that the form is filled out as completely as possible and send it with the physical sample. Once a client has filled out the form, you may choose to make a copy for your records prior to sending it with each sample submitted.

Note: We still have a supply of the three-part forms on hand. Many of you may also have a supply in your office. You may continue to use them; however, keep the yellow and pink copies for your records and send only the top white copy to us. We would be happy to send more forms to you at your request as before, but when our supply is depleted, you will need to make your own copies. In any case, make sure to include a form with each sample submitted.

In addition to this standard form, a supplementary Tree and Shrub Disease Identification Form must be completed for all tree and shrub problems. A copy of this form can be found in the [appendix](#) of this document (page 30,31). Please print the form on yellow paper.

➤ EMAIL Notification of Diagnosis

ATTENTION

Beginning March 1, 2014, our diagnostic reports for samples will be sent by EMAIL only. We will no-longer mail hardcopies, i.e., the original [white] copy to growers or second [yellow] copy to the Extension Agent or County Extension Office. Once a diagnosis is made, if the grower has provided an email address, the diagnostic report will be emailed directly to him/her as a "Speedy-reply" pdf file and the Extension Agent/County Extension Office will be copied on the email. If an email address is not provided by the grower, the Laboratory will not notify the grower of the laboratory results; the diagnostic report will be emailed directly to the Extension Agent and County Extension Office. It then becomes the responsibility of the Extension Agent to communicate the results to the grower in a timely manner.

Note to Agents: At your request or at our discretion, the diagnostic report may be sent directly to you as before (electronic response only) and not sent to the grower. Whenever you prefer to receive the report rather than the grower, draw a circle around your name on the plant disease identification form or otherwise note this preference on the form.

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Turn-around time and delays in diagnosis.

Every effort is made to examine all specimens the day they are received or the following work day. In most cases, the diagnosis is made the same day the sample is examined. Should there be a delay in diagnosis because we are performing a special diagnostic test or consulting with another Specialist, Agents will be notified via e-mail.

Tips for Packaging Plant Specimens

Our diagnosis depends entirely on the information provided and the sample submitted. It is up to you to screen the samples that are brought into your office and occasionally to reject those which you know are inadequate or in poor condition. Also, the proper packaging of samples for mailing is very important: It does not do any good to send an adequate, fresh specimen if it deteriorates en route!

The following tips are meant to give you guidelines for the kind of specimen that should be submitted and how it should be packaged to maintain its freshness as much as possible. We hope these suggestions will help you and, as a result, enable us to provide a better diagnostic service to your county! For more detailed instructions, see UK Extension Publication PPFS-GEN-9, **Submitting Plant Specimens for Disease Diagnosis**.

Submit several plant specimens

Whenever possible, the grower should submit several whole plant samples, including the root systems. Generally, submitting only one or two leaves is unacceptable. Samples should show the various stages of disease development. (If possible, identify the samples depicting the various stages.) When the whole plant cannot be submitted, large portions of the plant(s) make the best samples. Branch specimens should be at least 12 inches long.

Fill in the Plant Disease Identification form for all specimens.

All the questions on the form should be filled in completely by the grower. This may require quizzing the grower to get all the necessary information. Woody specimens must also be accompanied by a Tree and Shrub Disease Identification Form.

Package in plastic bags and/or newspaper. Plant specimens often dry out en route; therefore, all samples should be enclosed in a plastic bag. However, fleshy fruits, vegetables, or tubers in the early stage of decay and mushrooms for identification should be wrapped individually in dry newspaper and packaged loosely in a plastic bag rather than tightly sealed.

Do not add water or use wet paper towels.

Moisture hastens decay and the growth of saprophytic organisms, obscuring the real problem.

Cover and tie off the root ball.

Place the root system (with any accompanying soil) in a plastic bag and tie it securely to the lower stem of the plant. Place a second bag over the foliage portion of the plant in order to reduce desiccation.

Include identifying labels and diagnostic forms.

Protect forms from soil and moisture by sealing them in a separate plastic bag or envelope.

Make sure to package delicate material in a sturdy box.

Corrugated cardboard boxes or mailing tubes make the best mailers. Thin or flimsy boxes are easily damaged and are frequently crushed by the time we receive them. If you do use a non-corrugated box, please enclose it in a sturdier box for mailing. Padded envelopes are good for flat samples which are not likely to be damaged by the rough handling they will receive in the mail.

Mail all packages First Class.

Mail packages early in the week.

This will help to avoid delays that occur when the package is en route over the weekend.

Mailing addresses:

Plant Disease Diagnostic Laboratories

Lexington

Plant Disease Diagnostic Laboratory
Agricultural Science Building-North
Lexington, KY 40546-0091

Fax (859) 323-1961

Princeton

Plant Disease Diagnostic Laboratory
P.O. Box 469 or 1205 Hopkinsville Street
UK Research & Education Center
Princeton, KY 42445-0469

Fax (270) 365-2667

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Publications

Enclosures

ATTENTION

We will no-longer mail hardcopies of Extension publications with our diagnostic reports. Reports will be sent electronically. Extension publications will be referenced within the report, noting that they are available on-line or that copies may be picked up at the local County Extension Office.

➤ **PPA and Fact Sheets (PPFS) from the Dept. of Plant Pathology**

Publications and Fact Sheets deal specifically with biotic and/or abiotic plant problems or contain plant disease information. Copies of older publications are available from the Ag Distribution Center, University of Kentucky, Lexington, KY 40546-0229. Many of the newest publications are available on-line from the Extension Plant Pathology web site at <http://www2.ca.uky.edu/agcollege/plantpathology/extension/pubs.html>

Plant Pathology Fact Sheets (PPFS) were developed by the Extension specialists and diagnosticians to provide pertinent information on plant disease/disorders. They include background information and specific disease control/preventative measures. All of the Fact Sheets are available from the Extension Plant Pathology Website at <http://www2.ca.uky.edu/agcollege/plantpathology/extension/pubs.html>

Below are the abbreviations for other Departmental publications with links to their websites.

- AGR** [Plant & Soil Sciences Department Publication](#) (UK Ag. Communications Service) [Search Extension Publications here.](#)
- ENTFACT** [Entomology Department Fact Sheets](#) (UK Entomology Department)
- HO** Horticulture Department Fact Sheet (UK Ag. Communications Service)
[Commercial Horticulture](#)
[Home Horticulture](#)
- ID** [Inter-department Publication](#) (UK Ag. Communications Service)

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Soybean Cyst Nematode Samples

ATTENTION

SCN analysis services have been suspended indefinitely, effective January 1, 2014 due to imminent personnel changes in the UK Soybean Cyst Nematode (SCN) Laboratory. Services may resume at a later date, but this has yet to be determined. In the meantime, all Kentucky growers who desire to have soil tested for SCN are encouraged to use the services of the University of Missouri Plant Nematology Laboratory. The cost per sample for an SCN egg count is \$20. The lab also offers HG (race) testing services, if needed, for an additional fee.

Note: Samples received by the UK SCN Laboratory after January 1, will be returned to sender and will not be processed; no exceptions can be made.

Below is the website for the University of Missouri Plant Nematology Laboratory. Please note it will be necessary to use their sample submission form, which is available via a link on the Laboratory's website <http://soilplantlab.missouri.edu/nematode/>.

Soybean Cyst Nematode Samples for the Nursery Trade

SCN Analysis for Nursery soils will continue without suspension, see publication [ID-110](#), "Soybean Cyst Nematode: A Potential Problem for Nurseries". A copy of the Soybean Cyst Nematode Analysis Form for the Nursery Trade can be [downloaded from here](#).

For additional information please contact Brenda Kennedy at the Plant Disease Diagnostic Laboratory, 270/365-7541 ext. 228.

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Walk-In Policy

Each year the Plant Disease Diagnostic Laboratory receives a number of non-Extension walk-ins (plant specimens from commercial growers, homeowners, consultants, and other clients that are not part of the Cooperative Extension Service). A majority of these clients expect (and usually have received) immediate attention to their plant problems. Increasing awareness of the Laboratory's services and its location has brought increasing numbers of these non-Extension walk-ins. This has created problems for the Diagnostician and Extension Specialists working in the Laboratory. First, it causes interruptions in work on specimens Extension personnel have mailed or brought to the Laboratory. Secondly, time is frequently used unwisely discussing the walk-in client's plant and other problems. To increase Laboratory efficiency, we have formed a policy establishing the priorities by which samples will be handled.

Priorities for handling specimens

It is the primary purpose of the Plant Disease Diagnostic Laboratory to assist County Extension Agents and State Specialists in the diagnosis of plant disease problems. In keeping with this purpose, the following will be our priorities for handling specimens.

Priority Level	Sample Source
1	County Extension Agent and Extension Specialist walk-ins desiring an immediate reply.
2	Samples mailed in from County Extension Offices.
3	Samples hand-delivered from County Agents, but for which an immediate reply is not requested.
4	Samples mailed in directly from non-Extension clientele.
5	All other walk-ins. This includes commercial growers, homeowners, consultants, and professionals (e.g. lawn service, tree service, nursery workers, etc).

Clients in the last category will be asked to complete the appropriate form(s) to be left with the sample(s). We then encourage these clients to contact their County Extension Agent regarding any future plant problems. We may send an electronic "courtesy copy" of any reports for walk-in clients to the appropriate County Extension Agent.

Note to Extension Agents: If a client contacts you about a plant problem and you subsequently advise them to hand-deliver the sample to our Laboratory, please have them tell us this at the time they deliver the sample. We will prioritize this type of sample as if it were submitted by the Extension Agent (rather than as a "walk-in").

Samples left in the Diagnostic Laboratory unaccompanied by a completed diagnostic form(s) will not be processed.

If you have any questions about this policy, please contact an Extension Plant Pathologist or Diagnostician (see [list](#)).

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Digital Resources

➤ Digital Consulting System

A Digital Consulting System (DCS) is available for county Extension Agents to submit images of diseased plants to the PDDL Diagnosticians and Extension Plant Pathology specialists. Images are often a helpful supplement to physical plant samples.

ATTENTION

The DCS is currently under revision; expected to launch March 2014.

Plant Disease News Outlets

➤ [Kentucky Pest News \(KPN\)](#)

This is a newsletter which provides timely information on anticipated and occurring diseases, insects, and pesticide information in Kentucky. KPN is published weekly during the peak growing season and bi-weekly the remainder of the year.

➤ [Kentucky Tobacco Plant Disease Page](#)



Information and updates on current diseases of Kentucky tobacco.

➤ [UK – Diseases of Fruit Crops, Ornamentals, & Forest Trees](#)



Dr. Nicole Ward Gauthier, Asst Professor in the Dept of Plant Pathology at UK focuses on diseases of fruit crops, ornamentals, and forest trees. "Like" this site to follow us.

➤ [Grain Crops Update](#)

Updates are provided by Extension faculty with responsibilities for management of corn, soybean and small grains.

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“Where to Send What” Guide to UK Agricultural Diagnostic Services

To prevent unnecessary delays when specimens must be re-routed, please be sure to use the appropriate form and mail samples or inquires directly to the correct Department or Laboratory.

Type of problem	Where to send it
Consultations on plant problems/identification	Digital Consulting System (DCS)
Insect injury suspected Insect identification Insect control information	Extension Entomologist Department of Entomology S-225 Ag. Science Center - North Univ. of KY; Lexington, KY 40546-0091
Weed identification Weed control information Herbicide injury suspected	Weed Control Specialist Department of Plant & Soil Sciences Plant Sciences building 1405 Veterans Drive Lexington, KY 40546-0312 - FORM
Woody Plant and Wildflower Identification	UK Herbarium Forestry Dept., Lexington - FORM
Test for triazines (herbicide) in soil (\$) Endophyte testing (\$) (Under “All other tests”) Seed Germination Test (\$)	Regulatory Services 103 Regulatory Services Bldg Univ. of Kentucky; Lexington 40546-0275
Soil test for nutrients (\$)	Regulatory Services Lex (address above) OR Regulatory Services Soil Testing Laboratory PO Box 469 or 1205 Hopkinsville Street Princeton, KY 42445-0469
Plant tissue analysis for nutrients (\$)	Waters , Owensboro, KY A&L Labs , Memphis, TN Spectrum Analytic , Washington Court Hse, OH
Test for nitrate levels in corn (\$) Test for prussic acid levels in sorghum (\$)	Breathitt Veterinary Center Murray State University PO Box 2000/715 North Drive Hopkinsville, KY 42241-2000 (270) 886-3959
Mycotoxin test (\$) (e.g. aflatoxins, fumonisins, zearalanone, vomitoxin)	See PPFS-MISC-01 for a list of recommended labs
Hay/Forage Quality Testing (\$)	Kentucky Dept. of Agriculture 800-248-4628

Type of problem	Where to send it
*Plant disease problems on all crops/ Mushroom identification	Plant Disease Diagnostic Laboratory Agricultural Science Building – North University of Kentucky; Lexington, KY 40546-0091 Or PO Box 469 or 1205 Hopkinsville Street UK Research and Education Center Princeton, KY 42445-0469
Soil for SCN analysis (\$)	University of Missouri Plant Nematology Lab
Soil for SCN analysis for Nursery Crops (\$)	Plant Disease Diagnostic Laboratory PO Box 469 or 1205 Hopkinsville Street UK Research and Education Center Princeton, KY 42445-0469

*All plant samples should be sent to the laboratory that has been designated for your county.

Extension Plant Pathologists Diagnosticians/Technicians Administrators

Personnel	Office phone	Area of specialty
Donald Hershman	270/365-7541 ext. 215	Soybeans; Small Grains; Canola
Paul Vincelli	859/218-0722	Forage Crops; Turfgrasses; Corn and Sorghum
Kenny Seebold	859/218-0721	Tobacco; Vegetables
Nicole Ward Gauthier	859/218-0720	Landscape Plants, Fruit, Forest
Julie Beale	859/257-8949	Diagnostician, Lexington PDDL
Sara Long	859/257-8949	Diagnostic Aide Lexington PDDL
Brenda Kennedy	270/365-7541 ext. 228	Diagnostician Princeton PDDL
Bernadette Amsden	859/281-0723	Research Analyst
Ed Dixon	859/218-1290	Research Analyst
Cheryl Kaiser	859/218-1289	Extension Staff Assoc., Lexington
Chris Schardl	859/218-0730	Plant Pathology Dept. Chair; Extension Administration

Training Opportunities

➤ **Staff Assistant Training**

This training program is geared toward County Extension Staff assistants; however, Agents would also benefit from attending. Sessions are conducted on an area-wide basis during the fall to spring period, upon request. The Diagnosticians lead the sessions, discussing the specifics of sample submission, forms, packaging specimens, interviewing growers, and what constitutes a good specimen. For more information, contact either Julie Beale (859/218-8949) or Brenda Kennedy (270/365-7541 ext. 228).

Plant Pathology Specialists provide training in plant pathology for County Agents by area or multiple areas. Sometimes training is oriented towards new Agents, while other times it is more advanced. Check with your District Director for specific training times and topics. Also see [County Agent Training & Support webpage](#).

➤ **UK Diagnostic Images**

[Images](#) of plant diseases/disorders of many crops, landscape plants, fruits, and vegetables.

➤ **PowerPoint® Presentations- Master Gardeners**

See the [Internal Software Downloads webpage](#) under protected software collection to download the presentations for County use.

➤ **UKAg Video Center**

Videos covering many topics are now readily available on-line at the [Video Center](#).

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HERBACEOUS ORNAMENTAL REFERENCES

Winston C. Dunwell and Brenda Kennedy
Extension Horticulture Specialist and Plant Diagnostician
University of Kentucky, Research and Education Center Princeton, KY

January 2014

For an extensive list of publications and links from Dr. Win Dunwell, see his webpage called "Ornamental and Environmental Horticulture Books"

<http://www.ca.uky.edu/HLA/Dunwell/oebooks.html>

Herbaceous Perennial Plants, 3rd edition. 2008. Allan Armitage. Stipes Publishing Co. 1224 pp. \$68.90 (paperback) \$84.80 (hardcover). <http://www.stipes.com/horticulture.html>

Armitage's Garden Annuals. 2004. Allan Armitage. Timber Press, Inc. Portland, OR 1-800-327-5680 386 pp. \$32.97 (hardcover).

Armitage's Garden Perennials, 2nd edition. 2011. Allan Armitage. Timber Press, Inc. Portland, OR 1-800-327-5680 348 pp. \$49.95 (hardcover).
http://www.timberpress.com/books/armitages_garden_perennials/armitage/9781604690385

Armitage's Manual of Annuals, Biennials and Half-hardy Perennials. 2001. Allan Armitage. Timber Press, Inc. Portland, OR 604 pp. \$39.95 (hardcover). Available, but out of print.

Manual of Herbaceous Ornamental Plants, 4th edition. 1994. S.M. Still. Stipes Publishing Co. 814 pp. Hardcover \$74.80 Paperback \$58.80. <http://www.stipes.com/horticulture.html#herbs>

Ball Perennial Manual. 1996. Nau, J. Ball Publishing, Batavia, IL. 512 pp. \$64.95.
<http://www.ballbookshelf.com/DisplayDetail.aspx?bpid=1287>

Ball Redbook, Volumes I & II 2011. Ball, V. (ed.) Ball Publishing, Batavia, IL. 850 pp. \$54.95, \$73.95. Ball Publishing. <http://www.ballbookshelf.com/Default.aspx>

Diseases of Herbaceous Perennials. 2009. Gleason, M.L., M. Daughtrey, A.R. Chase, G. Moorman, and D.S. Mueller. [APS Press](#). 296 pp. \$89.00 (hardcover).

Diseases of Annuals and Perennials. 1995. Chase A.R., M. Daughtrey, and G. Simone. Ball Publishing, Batavia, IL 208 pp. \$54.00 from [APS Press](#).

The American Horticultural Society Pests and Diseases. 2000. P. Greenwood, A. Halstead, A.R. Chase and D. Gilrein. DK Publishing, 218 pp. \$13.00-34.95 used (hardcover). (Note: Becoming scarce.)

Ball Field Guide to Diseases of Greenhouse Ornamentals. 1992. Daughtrey, M. and A.R. Chase. Ball Publishing, Batavia, IL. 218 pp. \$59.00 [APS Press](#).

The Ortho Problem Solver, 7th edition. 2008. Smith, M. (ed.) Ortho Information Services 1040 pp. (hardcover). Now available as a free iphone App

<http://www.scotts.com/smg/goART2/InfoHowTo/download-the-new-ortho-problem-solver-iphone-app-/20300006///>

The North American Guide to Common Poisonous Plants and Mushrooms. 2009. Turner, Nancy J. and Patrick von Aderkas. Timber Press, Inc. Portland, OR 1-800-327-5680 324 pp. \$29.95 (paperback).

http://www.timberpress.com/books/north_american_guide_common_poisonous_plants_mushrooms/turner/9780881929294

Foliage Plant Diseases Diagnosis and Control. 1997. A.R. Chase. American Phytopathological Society. 168 pp. \$79.00 (Note: Becoming scarce.).

Managing Diseases in Greenhouse Crops. 1992. W.R.. Jarvis. American Phytopathological Society. 288 pp. \$95.00 Available: see [APS Press](#).

Disease Compendia - available from the [American Phytopathological Society Press](#), 3340 Pilot Knob Road, St. Paul MN 55121 1-800-328-7560 \$69.00 each.

[Compendium of Chrysanthemum Diseases](#), 1997

[Compendium of Flowering Potted Plant Diseases](#), 1995

[Compendium of Ornamental Foliage Plant Diseases](#), 1987

Note: Many of the above references are available at the online bookstores: Amazon.com and American Nurseryman <http://store.amerinnursery.com/>

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NURSERY AND ARBORIST REFERENCES

Winston C. Dunwell and Brenda Kennedy
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January 2014

For an extensive list of publications and links from Dr. Win Dunwell, see his webpage called "Ornamental and Environmental Horticulture Books"

<http://www.ca.uky.edu/HLA/Dunwell/oehbooks.html>

American Standard for Nursery Stock. 2004. American Association of Nurserymen. 113 pp. \$74.95 (3-ring binder) or online at http://americanhort.org/documents/nursery_stock_standards_AmericanHort_2004.pdf search for title.

The Reference Manual of Woody Plant Propagation, 2nd Edition. 2006. Dirr, M.A. and C.W. Heuser, Jr. Varsity Press, Inc. Athens, GA 30604 239 pp. \$49.95.

Best Management Practices: Guide for Producing Nursery Crops, 2nd Edition. 2007 Southern Nursery Association. 103 pp. Purchase from the Kentucky Nursery and Landscape Association: Betsie A. Taylor, KNLA Exec. Dir., 216 Pendleton Lane, Frankfort, Ky. 40601, Frankfort, KY 40601; 502.848.0055, 800.735.9791; Fax, 502.848.0013; e-mail, KNLA@mis.net; <http://www.knla.org/> \$75.00 for members, \$100.00 for non-members.

IPM Calendar for Deciduous Tree Production, 2008. Fulcher, Amy.
<http://www.ca.uky.edu/HLA/Dunwell/ipmcalendar2008.pdf>

Scouting and Monitoring Pests of Deciduous Trees during Nursery Production. Amy Fulcher, UT Extension w142
<https://utextension.tennessee.edu/publications/Documents/W142.pdf> Free

IPMPro and IPMLite apps for iPhone and Android see your App Store or <http://wiki.bugwood.org/SNIPM> for downloads

IPM for Select Deciduous Trees in Southeastern US Nursery Production. 2012. Available for download by chapter at http://wiki.bugwood.org/IPM_book

UT-UK IPM for Shrub Production. 2013. Fulcher, Amy and Mark Halcomb.
http://plantsciences.utk.edu/fulcher_IPM_manual.htm

UT-UK IPM Calendar for Ornamental Shrub Production. 2013. Yearly, Whitney and Amy Fulcher. http://plantsciences.utk.edu/pdf/fulcher_IPM_shrub_calendar_FINAL.pdf

IPMPro app for Green industry Professionals. 2012. Fulcher, et. al.
<http://www.ipmproapp.com>

IPMLite app for Consumers. 2012. Fulcher, et.al. <http://www.ipmliteapp.com>

Arboriculture: Integrated management of Landscape Trees, Shrubs, and Vines. 4th edition 2003. Harris, R. Prentice-Hall, Inc., Englewood Cliffs, NJ 07632 687 pp. \$127.40(paperback)

Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses. 6th edition. 2009. Dirr, M.A. Stipes Publishing Co., Champaign-Urbana, IL 826 pp. \$76.80 (paperback). <http://www.stipes.com/horticulture.html>

Dirr's Encyclopedia of Trees and Shrubs. 2011. Dirr, M.A. Timber Press, Inc. Portland, OR 1-800-327-5680 952 pp. \$79.95.
http://www.timberpress.com/books/dirrs_encyclopedia_trees_shrubs/dirr/9780881929010

Principles and Practices of Planting Trees and Shrubs. 1997. International Society of Arboriculture, Savoy, IL 200pp. \$49.95.

Scouting and Controlling Woody Ornamental Diseases in Landscapes and Nurseries. 1992. Moorman, G.W. Penn State University. [Available from:](#) Publication Distribution Center, Penn State Univ., University Park, PA 16802-260 290 pp. Available for free.

Diseases of Woody Ornamental Plants and Their Control in Nurseries. Jones, R.K. and D. M. Benson (eds.) 2001. Available from: [American Phytopathological Society Press](#), 3340 Pilot Knob Road, St. Paul MN 55121 1-800-328-7560. 350 pp. \$89.00.

Pirone's Tree Maintenance. 7th edition, 2000. Hartman, J.R., T.P. Pirone, and M.A. Sall. Oxford University Press. 514 pp. \$60.24.

Diseases of Trees and Shrubs, 2nd edition. 2005. Sinclair, W.A., H.H. Lyon, and W.T. Johnson. Comstock Publishing Assoc., Cornell Univ. Press, Ithaca, NY 574 pp. \$72.34.

Insects That Feed on Trees and Shrubs, 2nd edition. 1991. Johnson, W.T. and H.H. Lyon. Comstock Publishing Assoc., Cornell University, Ithaca, NY 556 pp. \$71.97.

The Ortho Problem Solver, 7th edition. 2008. Smith, M. (ed.) Ortho Information Services 1040 pp. \$107.12 (hardcover). Now available as a free iphone App
<http://www.scotts.com/msg/goART2/InfoHowTo/download-the-new-ortho-problem-solver-iphone-app-/20300006///>

The American Horticultural Society Pests and Diseases. 2000. P. Greenwood, A. Halstead, A.R. Chase and D. Gilrein. DK Publishing, 218 pp. \$13.00-34.95 used (hardcover). (Note: Becoming scarce.)

Broadleaved Shrubs and Shade Trees: Problems, Picture Clues, and Management Options. 2009. Northeast Regional Agricultural Engineering Service 180 pp. \$35.00
http://www.nraes.org/nra_order.taf?function=detail&pr_id=183&UserReference=054EB70EF3607FA64ED4EF0A

Ball Field Guide to Diseases of Greenhouse Ornamentals. 1992. Daughtrey, M. and A.R. Chase. Ball Publishing, Batavia, IL. 218 pp. \$59.00 [APS Press](#).

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http://www.timberpress.com/books/north_american_guide_common_poisonous_plants_mushrooms/turner/9780881929294

Disease Compendia - available from [American Phytopathological Society Press](#), 3340 Pilot Knob Road, St. Paul MN 55121 1-800-328-7560 \$69.00 and up each.

[Compendium of Conifer Diseases](#), 1997

[Compendium of Turfgrass Diseases, 3rd edition](#), 2005

[Compendium of Rose Diseases, 2nd edition](#), 2007

[Compendium of Rhododendron and Azalea Diseases](#), 1986

Note: Many of the above references are available at the online bookstore American Nurseryman <http://www.amerinnursery.com/> and Amazon.com.

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FRUIT REFERENCES

John Strang and Brenda Kennedy
Extension Horticulture Specialist and Plant Diagnostician
University of Kentucky

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VEGETABLE REFERENCES

Shubin Saha and Brenda Kennedy
Extension Horticulture Specialist-Vegetable Crops and Plant Diagnostician
University of Kentucky

January 2014

Make sure to check out UK's Center for Crop Diversification, online at

<http://www.uky.edu/Aq/CCD/> and like their facebook page.



We highly recommend Knott's Handbook and the book entitled "Vegetable Diseases" (see below). The Specialty and Minor Crops Handbook (see below) from California is also highly recommended. Much more up-to-date information is now found on the web and the reference pages from the "Vegetable Production and Marketing Information Online: Selected Links for Commercial Growers" should be your guide

<http://www.uky.edu/hort/documents-list-commercial-vegetable>

Knott's Handbook for Vegetable Growers, 5th edition. 2007. Maynard, D.N., and G.J. Hochmuth. John Wiley & Sons. 640 pp. \$69.90 (paperback); also available online at <http://onlinelibrary.wiley.com/doi/10.1002/9780470121474.fmatter/pdf>

Vegetable Diseases. 2007. Koike, Steven T., P. Gladders, and A.O. Paulus, Academic Press. 448 pp. \$239.00 ([APS Press](#))

Any of the APS compendiums would be a great addition to your library. Start with tomatoes, then cucurbits and add the others.

Disease Compendia - available from the [American Phytopathological Society Press](#), 3340 Pilot Knob Road, St. Paul MN 55121 1-800-328-7560 \$69.00 and up each.

[Compendium of Tomato Diseases, 2nd edition](#), 2014

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<http://pubs.cas.psu.edu/PubTitle.asp?varTitle=Identifying+Diseases+of+Vegetables&Submit=Go>

Diseases and Pests of Vegetable Crops in Canada. 1994. Howard, Ronald J., J.A. Garland, and W.L. Seaman. The Canadian Phytopathological Society and the Entomological Society of Canada. 554 pp. This book is currently out of print, but will be available for a free download in the Spring 2014. Check this link for updates: <http://www.esc-sec.ca/book.php>

Pests of the Garden and Small Farm. 1999. M.L. Flint. Regents of the University of California. Statewide Integrated Pest Management Project, University of California, Division of Agriculture and Natural Resources 1-800-994-8849, Fax 510-643-5470 286 pp. \$35.00
<http://www.ucpress.edu/book.php?isbn=9780520218109>

Greenhouse IPM Manual with an Emphasis on Biocontrols. Penn State University, Publications Distribution Center, 112 Agr. Admin. Building, University Park, PA 16802. Phone: 814-865-6713 Available online at
<http://extension.psu.edu/ipm/pestproblemsolver/manuals/greenhousemanual/greenhousepdf/view>

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Plant Pathology Terms

Have you ever been confused by the terms used by your friendly, local Plant Disease Specialist? Or are some of the terms used on the Plant Disease Identification Form confusing to you? As with other professionals, Plant Pathologists have a language of their own. The following definitions should help clarify some of the commonly used plant pathology jargon.

Symptoms

- Blight..... Sudden death of foliage, blossoms or twigs suddenly killed by a pathogenic organism (e.g. fire blight of apple).
- Callus..... An overgrowth of host tissue formed in response to wounding or disease. The plant produces callus around the injured site in an attempt to close a wound.
- Canker..... A diseased, sunken, dead area in woody root, stem or branch tissues.
- Chlorotic/
Chlorosis..... Yellowing; a partial or complete lack of green color.
- Dieback..... The death of a shoot from the tip back towards the main stem.
- Distortion..... Applied to plant tissues which are abnormally curled, puckered or otherwise misshapen.
- Gall/swelling... A localized outgrowth (bump, protrusion).
- Gummosis..... An abnormal discharge of gum or resin from injured plant tissue.
- Leaf scorch.... Browning of leaf tissue along the leaf margins and/or between the veins.
- Mosaic..... Pattern of random patches of green and light green or yellow tissues on leaves or fruit.
- Mottling..... An irregular pattern of indistinct light and dark areas.
- Mummy..... A fleshy plant part (such as the fruit) which has lost its moisture, dried up, and become hard and wrinkled.
- Necrosis/
Necrotic..... Dead; the tissue usually appears brown to black.
- Rot/decay..... Disintegration of plant tissue; frequently results in a brown, black or water-soaked appearance of the tissue. Includes: root rot, stem rot, fruit decay or rot, crown rot, and soft rot.

- Shot-hole..... Approximately circular holes left in leaves when the center of a leaf spot has dropped out.
- Spotting..... Distinct, localized spots which may appear on leaves, fruit or other plant parts.
- Vascular discoloration... A browning of the water-conducting tissues of a plant. A cut into the stem, root or tuber must be made to observe this.
- Wilt..... Loss of rigidity and drooping of plant parts resulting from insufficient water in the plant.
- Witch's broom. An abnormal brush-like development of many weak shoots or branches.

Distribution of diseased plants

- Entire planting. The problem is distributed throughout the entire planting.
- Every plant..... Every single plant (100% of crop, or very nearly so) in the field, garden or landscape is showing identical symptoms.
- Group of plants..... A discrete group of plants or a patch of plants is showing the same symptoms. All plants within the group are affected, while plants just outside this area are unaffected. More than one such group may be present in the field, garden or landscape.
- Large area..... A sizable portion of a field, garden or landscape is affected by the same problem.
- Part of plant.... Only a portion of the plant is affected.
- Scattered plants..... Single plants are affected and scattered throughout the planting among apparently healthy plants. Although these affected plants may be present over the entire field, this is not the same as "entire planting" since not every single plant is showing symptoms.
- Single plant.... Only one plant is affected; other plants of the same type are healthy.

Plant disease – general terms

Abiotic.....	Non-living (e.g. air pollution injury is an abiotic problem).
Biotic.....	Living, relating to living (e.g. <i>Cytospora</i> canker is a fungal disease, therefore it is a biotic problem).
Causal agent or causal organism.....	An agent or organism causing a particular disease (e.g. the bacterium <i>Erwinia amylovora</i> is the causal agent of fire blight).
Host.....	A plant which is harboring a pathogen. This term is also used in reference to a plant which may be susceptible to a particular pathogen.
Infection.....	The entry of an organism into a host and the establishment of a parasitic relationship.
Localized infection.....	An infection which occurs at a specific site with the pathogen not moving much beyond the site of infection. The pathogen cannot move internally throughout the plant.
Local lesion....	A localized spot produced on plant parts as a result of a localized infection.
Parasite.....	An organism which obtains food materials from another living organism. An obligate parasite can grow only on living tissue; it cannot feed on dead matter. A non obligate parasite can grow on dead matter as well as on living tissues.
Pathogen.....	An organism or virus capable of causing disease in a particular plant or plant group.
Saprophyte.....	An organism which obtains food materials from dead organic matter. A saprophyte often colonizes tissue that has already been killed by a parasite.
Secondary organism.....	A pathogen or saprophyte which normally only attacks a plant that has been weakened by other causes (e.g. drought) and is not the primary cause of the plant problem.
Systemic.....	Spreading internally throughout the plant body. Refers to a pathogen (e.g. Fusarium wilt of tomato - the fungus infects through the roots and, once in the vascular tissue, can move into the stem) or to a chemical (e.g. Benomyl is a systemic fungicide). Contrast this with a local lesion or localized infection (see above).
Vector.....	An organism able to transport and transmit a pathogen to a host (e.g. aphids can serve as vectors or carriers for certain viruses).
Wound parasite.....	A parasitic organism which can only become established in a host if there is a wound for its entry.

Fungi and their structures

Conidium (pl. conidia)..... An asexual fungal spore.

Conk (also: bracket fungus, shelf fungus)..... A large shelf like fungal fruiting body characteristic of many wood rotting fungi. Conks can be observed growing out of decaying trees, stumps and wood products.

Fruiting body... A complex fungal structure containing spores (e.g. pycnidium).

Mold..... Any "fuzzy" fungal growth which may be observed on decaying matter or on plant surfaces.

Mushroom (also: toadstool)..... Umbrella shaped fungal fruiting structures. Mushrooms can be observed at the base of trees, in lawns, woods, at the supermarket, etc.

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Appendix

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County:
County Extension Agent:
County sample number: <i>(county use—optional)</i>

Lab use only:	Lab file no.:
	Date received:
	Diagnostician:
	Date completed:



Plant Disease Identification Form

Send plant sample with completed form to:

Plant Disease Diagnostic Laboratory
Ag Science Building North
Lexington, KY 40546-0091

OR Plant Disease Diagnostic Laboratory
P.O. Box 469
Princeton, KY 42445

Grower: _____ Plant name: _____

Address: _____ Variety: _____

City: _____ Zip: _____ Date collected: _____

Email: _____

Phone: _____

Commercial sample: Yes No

Parts diseased:

- | | | |
|---|---|----------------------------------|
| <input type="checkbox"/> buds | <input type="checkbox"/> fruit | <input type="checkbox"/> flowers |
| <input type="checkbox"/> leaves/needles | <input type="checkbox"/> roots | <input type="checkbox"/> stems |
| <input type="checkbox"/> trunk | <input type="checkbox"/> twigs/branches | |

Symptoms:

- | | | |
|---|---|------------------------------------|
| <input type="checkbox"/> burn or scorch | <input type="checkbox"/> galls or swellings | <input type="checkbox"/> stem rot |
| <input type="checkbox"/> canker | <input type="checkbox"/> mottling | <input type="checkbox"/> stunting |
| <input type="checkbox"/> dieback | <input type="checkbox"/> root rot | <input type="checkbox"/> wilt |
| <input type="checkbox"/> distortion | <input type="checkbox"/> shot hole | <input type="checkbox"/> yellowing |
| <input type="checkbox"/> fruit decay | <input type="checkbox"/> spot | |
| <input type="checkbox"/> other: _____ | | |

Location of plant:

- | | | |
|-------------------------------------|------------------------------------|---|
| <input type="checkbox"/> field | <input type="checkbox"/> indoors | <input type="checkbox"/> orchard |
| <input type="checkbox"/> garden | <input type="checkbox"/> landscape | <input type="checkbox"/> outdoor floatbed |
| <input type="checkbox"/> greenhouse | <input type="checkbox"/> nursery | <input type="checkbox"/> plant bed |

Pattern of diseased plants:

- | | | |
|---|---|--|
| <input type="checkbox"/> single plant | <input type="checkbox"/> group(s) of plants | <input type="checkbox"/> entire planting |
| <input type="checkbox"/> scattered plants | <input type="checkbox"/> large area(s) | |

Is pattern associated with:

- | | | |
|---|---|---------------------------------|
| <input type="checkbox"/> cultivation patterns | <input type="checkbox"/> high, dry area | <input type="checkbox"/> shade |
| <input type="checkbox"/> field borders | <input type="checkbox"/> low, wet area | <input type="checkbox"/> slopes |

Percent of planting affected: _____

Date problem first noticed: _____

Planting date or age of plant: _____

Soil type: _____

Soil drainage: _____

Previous crop(s): _____

Tillage practices: _____

Recent weather and irrigation practices: _____

Unusual disturbances: lightning hail construction
 pruning injuries soil compaction flooding

Chemicals applied to this crop: *(include name, rate and date of application)*

Fertilizer: _____

Herbicides: _____

Fungicides: _____

Insecticides: _____

Additional information: _____

Please retain a copy of this form for your records.

An electronic diagnosis report will be sent to the local County Extension Office and to the client (if email address is provided).

TREE AND SHRUB DISEASE IDENTIFICATION FORM

Information to Supplement the Plant Disease Identification Form

Many tree and shrub problems are best diagnosed only after careful inspection of the whole plant in its growing site. However, because the plant disease diagnostician cannot visit the growing site, the grower's observations and information can be of tremendous help in formulating a diagnosis. The more information the grower provides, the better the diagnostician will be able to narrow down the cause(s) of the problem.

**Please complete as much of the following as possible in addition to the Plant Disease Identification Form
(Include relevant photos, if available)**

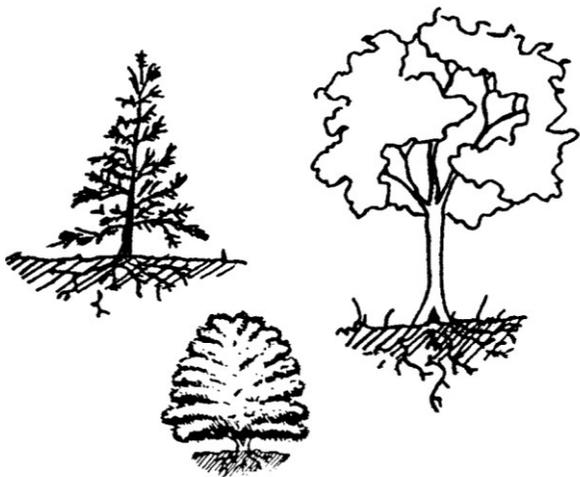
General Information

Approximate height (feet) _____ Trunk diameter (inches) _____ Trunk diameter at planting _____

Time in present site _____

Symptoms

1) What is the distribution of affected branches? Indicate location of damage on the diagram below.



- Scattered branches all over tree/shrub
- One portion of tree/shrub only
- Several portions of tree/shrub
- Entire plant
- Other _____

2) What is the progression of symptoms throughout the tree/shrub (e.g. from lower branches to top; from branch tips toward trunk; from one side to another, etc.)?

3) What is the progression of symptoms on leaves/needles? (e.g. leaf margins/needle tips inward; between leaf veins) _____

4) Has problem occurred: slowly or rather suddenly? How rapidly? _____

5) Are cankers, sunken areas, or injuries (mower, string trimmer, or other) present on main limbs or trunk? Yes No
 Describe size and location _____

How old are cankers or injuries indicated above? _____ Is there any evidence of "healing"(callus)? Yes No

6) Does tree have a girdling root up near trunk, at soil level, or below soil level? Yes No
 [Look for a large root forming a "noose" around trunk within 12 inches of soil surface. Mature trees (15 years or more) that are girdled lack a normal flare of the buttress roots and trunk will appear to go straight into the ground (like a telephone pole)].

(continued on reverse side)

- 7) Are there other plants of this type also showing the same symptoms? Yes No Are there healthy plants of the same type nearby? Yes No Are there other plants not of this type showing the same symptoms? Yes No
- 8) Are mushrooms, bracket fungi, or conks apparent on trunk or at base of tree/shrub? Yes No If so, describe:
-

Growing Site

- 1) Is tree/shrub surrounded by pavement or buildings? Yes No Is soil around tree/shrub compacted? Yes No
- 2) Is tree/shrub in full sun partial shade full shade
- 3) Have roots been disturbed in the past 5 years? Yes No Has the grade (soil level) around tree/shrub changed in the Past 5 years? Yes No If yes, explain soil added soil removed Reason _____
- 4) Is tree/shrub located in a low wet area or at the base of a downspout? Yes No Does water stand or puddle on soil after rain? Yes No Is tree/shrub in a site where topsoil was removed (e.g. a new home development)? Yes No

Cultural Practices

- 1) Is there mulch around tree/shrub base? Yes No Is there a tree guard around trunk Yes No
- 2) Has tree ever been topped Yes No When? _____
- 3) Has tree/shrub been bumped by lawn mower, string trimmer, or other equipment? Yes No
- 4) Have herbicides been used to control weeds in lawn around tree other _____
- 5) Is tree/shrub watered thoroughly during dry periods (equivalent of at least 1 inch of rain per week)? Yes No
- 6) If tree/shrub was transplanted in last 2 to 3 years, describe method _____
-
- Was plant bare root container-grown ball & burlap Container diameter _____ or root ball size _____
- If ball & burlap: type of root ball covering degradable burlap plastic other _____
- Before planting, was root ball covering removed loosened slit
- 7) What were the results of last soil test taken for this site? pH _____ P _____ K _____
- Ca-Mg _____ When was the last time tree/shrub or surrounding lawn was fertilized? _____
- [Be sure to indicate type of fertilizer on Plant Disease Identification form]
- How was fertilizer applied cores dug broadcast injection other _____
- Applied at drip line near trunk other _____

Additional Information



Educational programs of Kentucky Cooperative Extension serve all people regardless of race, color, age, sex, religion, disability, or national origin. University of Kentucky, Kentucky State University, U.S. Department of Agriculture, and Kentucky Counties, Cooperating. Disabilities accommodated with prior notification.