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Nursery Guidelines for the Exclusion and Management of *Phytophthora ramorum* in Nurseries¹

These nursery guidelines are designed to reduce risks associated with diseases caused by *Phytophthora ramorum*. The control of *P. ramorum* is based on minimizing the risk of introduction and preventing the survival of the pathogen in a nursery. On December 21, 2004, the USDA, APHIS adopted an Executive Order that requires all nurseries in Oregon, California, and Washington that export nursery stock to be surveyed for *Phytophthora ramorum*. The Oregon Department of Agriculture adopted a similar regulation shortly thereafter (*Phytophthora ramorum* Regulated Area for Nursery Stock). Items in bold-face are **required** under these regulations; other items are recommended but not required. The following practices are guidelines to assist nursery crop producers in developing an effective monitoring and action plan for *P. ramorum*. Each nursery should review these practices and use some or all of them depending upon their production systems and the plants grown.

EXCLUSION (Keeping *P. ramorum* out of the nursery – **Required for nurseries entered in Federal and/or State compliance agreements**)

- 1) Notify your State Department of Agriculture² of all incoming shipments of tree and shrub nursery stock from out-of-state within two business days of shipment arrival.** Notification 48-hr in advance of receiving shipments is encouraged as it will enable the State Department of Agriculture to provide a decision on the need to inspect before the shipment has arrived. Note that seeds and tissue culture plantlets are excluded from regulation.
- 2) Purchase hosts and associated hosts³ only from certified sources when such purchases originate in a Federally quarantined or regulated area where official *P. ramorum* certification programs acceptable to your State Department of Agriculture exist. Consult your State Department of Agriculture² website for a list of acceptable official certification programs and compliant growers and dealers.**
- 3) If purchasing from locations where no official certification program exists, have nursery stock officially inspected and tested for *P. ramorum* upon receipt. Keep these plants safeguarded and segregated from other hosts and associated host plants, and off sale, until test results are completed.** The segregation distance is measured from canopy to canopy, and should be at least 2 m. A distance of 12 m may be necessary to avoid a 90-day hold.³

¹These guidelines were developed in cooperation with the California Association of Nurseries, the Oregon Association of Nurseries, the Washington Nursery and Landscape Association, Oregon State University, the Oregon Department of Agriculture, and the Washington Department of Agriculture. For comments or suggestions contact Jennifer.Parke@oregonstate.edu. Updates will be available at http://extension.oregonstate.edu/emergency/oak_death.php

- 4) **Nurseries must maintain records of all incoming and outgoing shipments of hosts and associated hosts for a minimum of 24 months.** Identify the host or associated host species, cultivar, quantity, origin, date of shipment, and receiver. Landscapers should also keep records of plant purchases and planting sites for hosts and associated hosts. **Dealers must maintain records of incoming shipments for a minimum of 24 months.**
- 5) Off-load incoming shipments of host and/or associated host stock to an area that can be cleaned of leafy debris. Collect the debris from the receiving pad and the delivery truck and bag for disposal. Do not send this plant debris to your own plant dump or composting facility.
- 6) Visually inspect all incoming plant material (not just hosts and associated hosts) for symptoms of *P. ramorum* prior to it being incorporated into the production facility. See guides to recognizing symptoms on nursery hosts⁴. Report suspicious symptoms to your state Nursery Inspector.
- 7) Wholesale production nurseries should keep all incoming hosts and associated hosts in separate blocks at least 2-m from other hosts in the nursery for a minimum of 3 months during the growing season. This will allow symptoms to develop that initially might be masked by fungicides or delayed by weather conditions. A distance of 12 m may be necessary to avoid a 90-day hold.³
- 8) If possible, avoid product returns of host and/or associate host stock from a receiver located in a regulated area. If unavoidable, contact your state Nursery Inspector² prior to accepting the stock return.
- 9) If you visit known infested areas, wash your shoes, tools, or vehicles that may have contacted contaminated soil before traveling to disease-free areas. See APHIS protocols for disinfecting contaminated materials.³

CULTURAL PRACTICES TO REDUCE DISEASE RISK AND DISEASE LOSSES

NURSERY FIELD LAYOUT

- 10) Avoid large, uniform, contiguous blocks or fields of host and/or associated host plants. For container nurseries, break up the blocks or fields by inserting periodically at least 2 m wide lanes or blocks of non-host plants. Should *P. ramorum* be detected, all plant material in that block and within 2-meters will be destroyed. Keeping blocks small or interspersing non-hosts will help reduce your losses. See recommended nursery layout for minimizing crop losses and a list of plants at low risk for *P. ramorum*.³ For field-planted stock, plan ahead to avoid planting large continuous blocks of host/associated hosts.

SANITATION

- 11) Rake up fallen leaves for disposal.
- 12) If irrigation water is from any source other than a well or municipal water source, have your water tested to ensure that it is free of *Phytophthora* species, or

maintain a treatment program to eliminate *Phytophthora*. This is especially important if irrigation water is recirculated. Methods for disinfecting irrigation water include chlorination, ozonation, and UV irradiation.⁵

- 13) Propagate cuttings of hosts and associated hosts only from plants known to have been free of disease for several months. Sanitize cuttings to eliminate potential pathogens; soak cuttings in a disinfectant before storage and/or sticking in rooting medium.
- 14) Use new pots for propagating plants, or if you must re-use pots, clean them by first washing them to remove soil, then sanitizing by hot water or air-steam treatment (see APHIS disinfection guidelines³).
- 15) Disinfect tools and shoes that may have been in contact with contaminated plants or potting media (see APHIS disinfection guidelines³).
- 16) Use soilless potting media. If compost is used, ask the supplier for a list of ingredients and their source to make sure that it does not contain contaminated host material. Request a description of the composting procedure to ensure that it has undergone a period of high temperature (>55° C or 131° F for 14 days) to reduce or eliminate plant pathogens.
- 17) Do not recycle regulated plant material in your compost.
- 18) Ensure that your cull pile or burn pile is not near your potting media components or mixing area.
- 19) Avoid mixing potting media on bare soil.

FUNGICIDES

- 20) If you choose to use fungicides on hosts and associated host species, use them as preventative treatments only. Alternate or tank-mix fungicides from different families with different modes of action to reduce the likelihood that fungal resistance will develop.⁶
- 21) When you receive a shipment of hosts or associated hosts, set aside 100 plants or 10% of that lot (whichever is greater) and do not treat them with fungicides effective against *Phytophthora* species for 90 days. Observe these untreated plants for the development of symptoms that might otherwise be masked by fungicides.

WATER MANAGEMENT

- 22) Reduce the period that leaves remain wet. Drip irrigation is desirable, but if you use overhead irrigation, apply it at a time when it will not extend the dew period, or apply water at a time when leaves will dry rapidly.
- 23) Improve drainage in your nursery. Plant on raised beds or install tile drains to improve drainage. Place containers on a well-draining surface such as gravel. Avoid puddling, splashing and run-off to other plants.

MONITORING

- 24) **If your nursery sells hosts or associated host plants, it will be inspected and tested for *P. ramorum* annually by your State Department of Agriculture according to Federal and/or State guidelines. Once your nursery has passed inspection, you must enter into a compliance agreement with USDA, APHIS or your State Department of Agriculture stating that you agree to follow the four steps outlined under Exclusion. If your nursery sells non-host plants, it must be visually inspected annually for *P. ramorum* before you can ship nursery stock out-of-state. Failure to comply with the articles of the compliance agreement will result in revocation of the compliance agreement and decertification. Alternatively, your nursery may participate in a State Nursery Stock Cleanliness Program which documents inspection of all nursery stock for *P. ramorum* at the appropriate time of year. USDA, APHIS must approve this inspection, sampling and testing program.**
- 25) Frequently monitor hosts and associated hosts in your nursery for symptoms of *P. ramorum*. Be alert for symptoms on any shrub and tree species, including those not on the list of hosts and associated hosts. If you suspect that *P. ramorum* is present, contact your state Department of Agriculture². While waiting for the diagnosis, do not ship or move symptomatic plants or any nearby plants.
- 26) Monitor hosts and associated hosts on the perimeter of your nursery for symptoms of *P. ramorum* infection.
- 27) Check the list of hosts and associated hosts periodically, as additional species may be added to the list.³
- 28) Make nursery personnel aware of *Phytophthora ramorum*. Alert them to disease symptoms by making illustrated guides^{4,7} readily available to them and encouraging them to attend a training session about *P. ramorum*.
- 29) Learn how to use ELISA kits to detect *Phytophthora* species. Symptoms similar to those caused by *Phytophthora* species can be caused by other pathogens or abiotic disorders. The test kit can help to rule out *Phytophthora* species as the cause. The Pocket Diagnostics kit for *Phytophthora* is available from <http://www.pocketdiagnostic.com/splash2.html> . If you detect *Phytophthora*, notify your state Nursery Inspector to arrange for further diagnostic tests to determine which species of *Phytophthora* is present.

Information for Nursery Growers on Sudden Oak Death and *Phytophthora ramorum* (Dec. 2005)

Jennifer Parke, Oregon State University (Jennifer.Parke@oregonstate.edu)

¹Nursery guidelines for the exclusion and management of *Phytophthora ramorum* in nurseries
OR, WA, and CA: http://extension.oregonstate.edu/emergency/oak_death.php

²Contact information for Department of Agriculture for Washington, Oregon, and California:
WA: <http://agr.wa.gov/plantsinsects/diseases/sod/default.htm> Phone: 360-586-8459
OR: <http://oda.state.or.us/plant/ppd/path/SOD/index.html> Phone: Invasive Species Hotline
at 1-866-INVADER or Nursery Inspector at 503-986-4644.
CA: http://www.cdffa.ca.gov/phpps/pe/sod_survey/

³APHIS website for more information: <http://www.aphis.usda.gov/ppq/ispm/pramorom/>
List of hosts and associated hosts
http://www.aphis.usda.gov/ppq/ispm/pramorom/pdf_files/usdaprlist.pdf

⁴Illustrated guides for recognizing symptoms of *P. ramorum* on nursery hosts:
National: <http://www.ncipmc.org/sod/images.html>

WA: <http://agr.wa.gov/plantsinsects/diseases/sod/docs/PhytophthoraRamorumGuide.pdf>

OR: <http://eesc.orst.edu/agcomwebfile/edmat/EM8840.pdf>

CA: <http://suddenoakdeath.org> then follow links to nursery information and update, nursery
diagnostic guides and nursery photos

⁵Methods for disinfecting recirculating irrigation water:
<http://www.ento.okstate.edu/zoospore/managing/treat/index.html>

⁶Fungicide recommendations:
OR & WA: Pacific Northwest Plant Disease Management Handbook, or An Online Guide to
Plant Disease Control at <http://plant-disease.ippc.orst.edu/index.cfm>
CA: UC IPM Pest Management Guidelines for Floriculture and Ornamental Nurseries
<http://www.ipm.ucdavis.edu/PMG/selectnewpest.floriculture.html>

⁷General information on Sudden Oak Death and *Phytophthora ramorum*
California Oak Mortality Task Force <http://suddenoakdeath.org>
North Central IPM Center <http://www.ncipmc.org/sod/> (Powerpoint presentation, script,
and movie on *Phytophthora ramorum*)