

Buying healthy plants: What to look for at a nursery

A guide for California Native Plant Society chapters purchasing buy-ins for plant sales

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Prepared by the CNPS Ad Hoc Committee on Phytophthoras and the Phytophthoras in Native Habitats Work Group (www.calphytos.org)

The California Native Plant Society (CNPS) is the premier organization dedicated to preservation and protection of California's native flora. With 10,000 members and 34 regional chapters, the CNPS is the leader in native plant conservation, habitat restoration, and promotion of landscaping with native plants throughout the state. Chapters raise funds through plant sales, and those sales taken together comprise a significant network for native plant distribution to California's landscapes. However, that network can also inadvertently serve as a far-reaching pathway for plant pathogen movement to new areas.

In December 2015, the CNPS adopted a policy to promote native plant nursery practices that help prevent plant diseases and discourage the spread of *Phytophthora* species and other harmful plant pathogens. This policy gives special attention to stock sold by CNPS chapters, and offers support to chapters for purchasing clean stock.

To support CNPS policy, this document describes items to consider to help minimize the likelihood that your chapter will distribute contaminated nursery stock. By looking at the growing conditions of the plants you purchase and engaging in a conversation with the grower, your Chapter can check that plants were grown with practices that prevent the development of plant pathogens that could subsequently be spread to new areas and hamper successful landscaping projects while harming the natural environment.

We encourage you to support plant growers in implementing the clean growing practices that further the mission of the California Native Plant Society and protect native habitats. Thank you for contributing to these efforts!

How to use this guide

This guide is designed for use in multiple ways: photographs and descriptions show good growing practices to aid your visual inspections; suggested questions to begin to engage in a conversation with your grower; or some combination of these two tactics. Feel free to use this document as a starting point in an ongoing conversation with your nursery about growing clean, healthy plants. Remember, the goal is not perfection, but risk reduction. Every focus area of a

nursery's operation that is reviewed in this guide is a potential entry point for plant contamination.

More detailed information on these practices can be found in *Guidelines to Minimize Phytophthora Pathogens in Restoration Nurseries* (see www.calphytos.org) and *CNPS Best Management Practices for Producing Clean Nursery Stock* (see <https://sites.google.com/site/cnpsphytophthoraresources/>.)

Focus Area 1: The plants

Objective: Buy plants that are healthy both above and below ground.

Look for...	
<p>Shoot symptoms in <i>Phytophthora</i> infected plants may include (in order of increasing severity): low vigor, stunting, off color, intermittent wilting or water stress symptoms, leaf tip dieback, leaf blight, root collar and/or stem cankers, whole plant wilting or necrosis.</p> <p>Since California native plants are adapted to drought, root problems may not manifest in visible aboveground symptoms.</p>	 <p><i>All three of these toyon plants were confirmed with Phytophthora root infections despite looking healthy</i></p>
<p>Roots with severe <i>Phytophthora</i> rot may appear discolored, mushy or decorticated (outer soft tissues slough off, leaving only the woody vascular tissues). In less decayed roots, you may only see decay or discoloration of small side roots or newly-emerging root tips and overall root growth may be less than expected. There may be areas of apparently healthy roots and others that show decay. At early stages of disease or in some species it may be difficult to see any clear symptoms of disease.</p>	 <p><i>Typical root symptoms from Phytophthora infection versus healthy roots</i></p>

Focus Area 2: Containers


Objective: Use only clean containers to eliminate these as a potential source of pathogens.

Look for...		Ask...
<p>New or clean containers visibly free from soil and debris</p>	 <p><i>Pots should be free from any visible soil</i></p>	<p>Do you use new containers?</p> <p>Do you clean and sanitize used containers?</p>
<p>Washing/sanitizing station for cleaning used containers</p>	 <p><i>Two examples of container wash and sanitation options employed by California restoration nurseries</i></p>	<p>What steps do you take to clean or sanitize containers before re-use?</p> <p>Do you use recommended techniques like solarization or bleach disinfectants?</p>

<p>Clean containers stored off the ground on clean racks or shelves, or in covered bins</p> <p>No large piles of dirty containers, no storage of dirty containers near clean containers</p>	 <p><i>Piles of used pots are not a safe practice</i></p>	<p>Where do you store your clean containers?</p> <p>How do you keep your dirty containers separate from your clean containers?</p>
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Focus Area 3: Soil and potting materials

Objective: All potting media must be pathogen free and be handled and stored in a manner that precludes contamination.

Look for...	Ask your grower...
<p>Commercial potting materials that have been heat-treated and stored in sealed bags or enclosed bins with no direct contact with the ground.</p>	<p>Where do you buy your soil and soil components from?</p> <p>Is the soil already heat-treated?</p> <p>Are all the component parts of the soil-mix heat treated?</p>
<p>A system for heat treating non-commercial soil</p>  <p><i>Two examples of on-site heat treatment options employed by California restoration nurseries</i></p>	<p>Do you have a way to heat-treat the soil you use?</p>

Soil storage system that keeps clean soil off the ground and away from water and other contamination sources





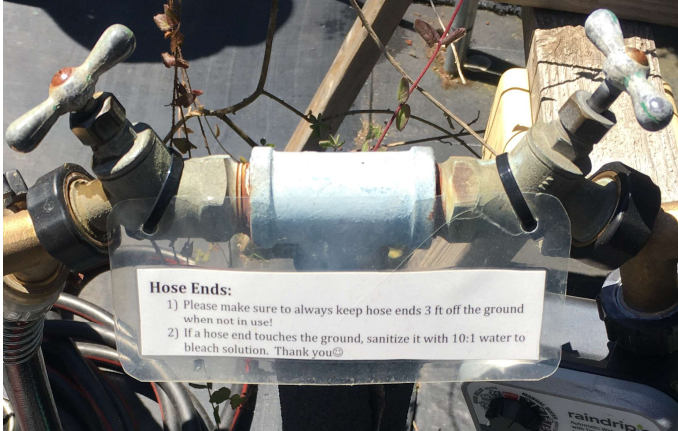
Soil storage areas at two California restoration nurseries

Do you store your soil off the ground and away from run-off and other contamination?

Focus Area 4: Water and irrigation

Objectives: Use only uncontaminated, appropriately-treated water for irrigation; Manage irrigation to minimize the risk of introducing contamination and development of Phytophthora diseases.

Look for...		Ask...
<p>Water sources that are treated to remove pathogens (either municipal supply or on-site treatment)</p>	 <p><i>Assume all surface water is contaminated</i></p>	<p>Where does your water come from?</p>
<p>Irrigation system that minimizes splash between containers (drip where feasible)</p>	 <p><i>An example of drip irrigation in a nursery setting</i></p>	<p>What kind of irrigation system do you use?</p>
<p>Irrigation that minimizes leaf wetness and avoids excessive pooling without stressing plants with inadequate water</p>		<p>What is your strategy for achieving “just right” watering that avoids conditions favorable to pathogen growth?</p>

<p>Hoses and wands kept off the ground</p>	 <p><i>Proper hose storage includes keeping hose wands or ends on hooks well above the ground</i></p>	<p>What is your system for keeping your irrigation equipment off the ground and out of the splash zone?</p>
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Focus Area 5: Work flow and layout

Objective: Use the design and layout of the nursery to reduce opportunities for introducing contamination into plant stock.

Look for...	Ask...
<p>Maximum separation between clean and potentially contaminated areas (including adjacent habitats and properties)</p> <p>Barriers or controlled access to restrict movement from contaminated areas to clean production zones</p>	<p>How do you keep potentially contaminated areas separate from your clean growing area?</p>
<p>Cull piles that are separated from clean production areas to limit cross-contamination</p>	<p>Where is your cull pile?</p> <p>Is it kept away from your clean grow areas?</p>
<p>A work flow pattern that always moves from clean-to-dirty, and never from dirty-to-clean</p>	<p>How do you move through your growing zone to keep everything clean as you go?</p>

Focus Area 6: Benches and growing areas

Objective: Provide enough space between plants and potential sources of contamination to minimize the risk of contamination via water splash.

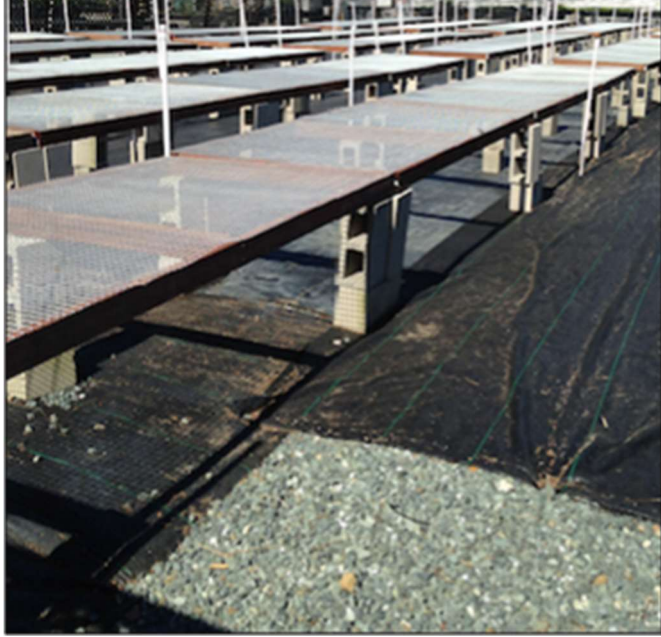
Look for...	Ask...
<p>Plants kept off the ground, ideally on benches 2-3 feet high</p>	<p>How high do you keep your plants off the ground?</p>
<p>Bench tops made of nonporous materials with an open grid that minimizes water movement between pots or dirt build-up</p> <p>Bench tops that can be effectively sanitized</p>	<p>What materials are your benches made of?</p> <p>How and when do you sanitize your bench tops?</p>
<p>Surfaces under benches and in walkways that are managed to prevent puddles and weeds</p>	<p>How do you manage puddles and weeds under and around grow benches?</p>



Plants grown on benches



Mesh wire as bench tops

<p>Ground surfaces that are covered (gravel, landscape fabric, pavers, etc.) to keep underlying soil covered while allowing for adequate drainage</p>	 <p><i>Nursery surfaces between and under benches are covered and allow for drainage</i></p>	<p>What kind of covering do you use to minimize contamination from the ground?</p>
<p>Spaces organized to allow for maximum space between plants within blocks, between blocks on benches, and between benches themselves</p>	<p>What kind of spacing do you provide between plants and benches to minimize potential cross-contamination?</p>	

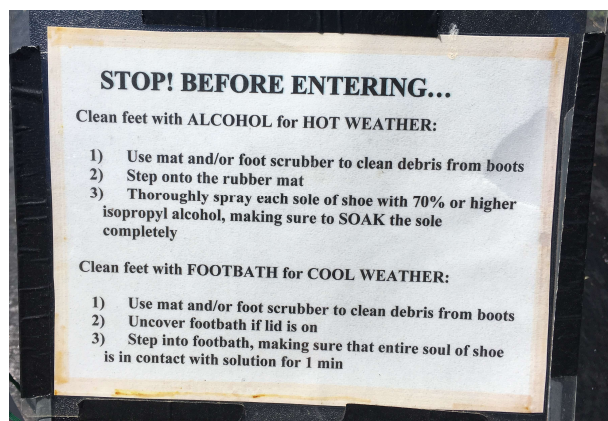
Focus Area 7: People and tools

Objectives: Ensure that all personnel that work in or visit the nursery consistently follow phytosanitary practices; Use thought and care in all aspects of plant handling to prevent contamination in various plant production and maintenance activities.

Look for...	Ask...
<p>Shoe-cleaning areas at entrances to clean growing zones</p>	<p>How do you keep contaminants from coming in?</p>



Visitors enter the clean portion of the nursery through a sanitizing foot bath



Foot bath instructions for visitors and staff

Workers wearing clean, waterproof gloves	What kinds of gloves and clothing do your workers use?
Sanitation system for gloves and tools that come into contact with potentially contaminated materials	How do you sanitize tools?

Focus Area 8: Amendments and chemical use

Objective: Avoid applying materials to plants that may be contaminated with pathogens or that will interfere with the testing procedures used to detect and eliminate infected plants in the nursery.

Look for...	Ask...
Use of systemic fungicides that can suppress but not eliminate pathogens	<p>Do you use any fungicides?</p> <p>Do you use any amendments (compost) that may be a vector for pathogens?</p>

Additional questions to consider

You will not be able to see every aspect of a nursery operation with direct observation. Some components may need questioning. To understand the full extent of a growing operation, consider a conversation about these additional topics.

Seeds and cuttings. *Objective: Start with propagative material that is free from infection or external contamination by Phytophthora species as well as other possible pathogens.*

- What is your method for collecting seeds and cuttings?
- Do you ever collect seed from the ground or take cuttings from plants that appear unhealthy?
- Do you avoid wet and muddy conditions during your collecting? How do you clean and store seed once you've collected it?
- How do you clean cuttings and other propagules?

Inspections and documentation. *Objectives: Identify potentially diseased material at the earliest possible stage so it can be culled in a timely manner to prevent further spread in the nursery; Maintain records that verify that inputs are clean, nursery workers are complying with clean production practices, and facilitate traceability of materials used for the production process.*

- How often do you inspect your plants and cull out any problems?
- What symptoms do you look for in terms of a root infection?
- Do you test for any pathogens?
- What records do you maintain to help keep track of all of your systems?

Thank you!

Your leadership as conscientious and informed buyers of nursery stock can help the entire native plant nursery system produce cleaner, healthier plants. We appreciate your attention and dedication to this issue. The CNPS Ad Hoc Committee on Phytophthoras and the Phytophthoras in Native Habitats Work Group are available to help answer additional questions, both about this guide and the practices recommended within. For more information see www.calphytos.org or the CNPS *Phytophthora* Resources at <https://sites.google.com/site/cnpsphytophthoraresources/>.

Glossary

Blocks – groupings of plants that are defined by clear separation from other groupings

Canker – a diseased area of plant tissue usually indicating a fungal or bacterial infection

Heat-treated – a treatment which raises the temperature of a material to a point where unwanted organisms are killed

Necrosis – an area of dead cells

Solarization – a method of heat-treating a material using heat from the sun

Photo credits

Janice Alexander, University of California Cooperative Extension; Suzanne Latham-Rooney, California Department of Food and Agriculture; Jennifer Parke, Oregon State University; Ted Swiecki, Phytosphere Research; and Mississippi State University Extension.