Hedgerow Farms, Inc.

Best Management Practices Manual

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Definitions:

Cull Pile – A pile of dead or discarded plant material and potting media.

POD – Phytophthora and other disease or pathogens

Potting media – substrate used for germinating, rooting, or growing plants in containers.

Sanitize/Disinfect – Cleaned to remove debris and soil particles and treated with a disinfecting agent (sodium hypochlorite, quaternary ammonium compounds, or alcohol) that destroys any residual plant pathogen propagules.

Host Plant – A plant which shelters, aids, or protects the growth of another organism

Infected – A plant that has a confirmed POD

1) Pest Prevention/Management

A. Exclusion of Pathogen

GOAL: To reduce the potential introduction and spread of Phytophthora species and other disease or pathogens through nursery trade and plantings.

a) Confirm nursery stock is propagated from clean (weed, pest, and pathogen free) seed.
   i) If species has potential for developing pathogens, seed should be treated accordingly. Example – Vitaflo, Apron, Maxim (Fungicides)
b) Avoid product returns of nursery stock from a receiver in a quarantined area and inspect plants for Phytophthora or other disease or pathogen (POD) symptoms.
c) Avoid comingling Phytophthora host plants
d) Visually inspect all incoming nursery stock, regardless of origin, for symptoms of Phytophthora and other disease (POD)
e) Off load incoming plant material on access road only. Do not allow trucks or any other vehicle inside the nursery.
   i) Nursery is located on raised platform above offload area.
f) Monitor sanitation practices of delivery trucks. Assure that any surface plant containers are properly sanitized.

B. Moisture Management

GOAL: Minimize moisture conditions conducive to Phytophthora species and other disease (POD).

I. Properly time irrigation events to reduce conditions favorable for disease development, in a manner to avoid prolonged leaf wetness. Extended leaf wetness (such as overnight) is conducive to infection by pathogen.
II. Keep possible off site contamination from entering the production location. Divert soil and water movement from adjacent areas that may be populated with POD host plants to prevent contamination of the nursery and plantings.
III. Avoid or minimize accumulation of standing surface water in nursery area.
IV. Scout for areas of growing moss/fungus on nursery floor or in exposed soil on nursery floor or in trays

C. Nursery Layout

GOAL: Reduce potential introduction and minimize the spread of POD through nursery trade and plantings.

I. Reduce potential inoculum dispersal from high risk plants to other crops.

i) Create a physical barrier between high risk plants and other crops.
ii) Create a 2 meter break between high risk plants and other crops.
iii) Interplant with non-host plants

II. Keep plants on rails or tables above 32 inches to reduce rain splash of inoculum.
III. Keep all surrounding vegetation clear for at least a 5 ft. border to reduce vegetation from entering the nursery.

IV. Use nursery tables or rails that eliminate lateral movement of water to come in contact with containers or trays.

V. Place lots as far away as possible as same species or species with same/similar pest problems that may be growing near the nursery.

Old Nursery Tables

New Nursery Tables/Rails

D. Cleaning and Sanitation/Plant Debris Handling and Disposal
GOAL: Reduce potential introduction and minimize the spread of POD through nursery practices and plantings.

I. Disinfect rails/tables where a lot has completely sold out, leaving a clean space for the next lot.
II. Disinfect mower blades after each lot is finished.
III. Disinfect nursery and kill weeds in nursery floor during summer when plant volume is low and more floor is exposed.
IV. Disinfect plug trays at Valley Transplant before using again, to reduce potential of any unknown residual contamination by POD.
V. Maintain a cull pile located downhill and downwind from nursery. Do not re use soil from cull pile. Quarantine and treat any infected material.
VI. Remove and dispose of plant debris in production area as needed.
VII. If known POD infested area has been visited, wash and sanitize everything accordingly.
VIII. Maintain a gravel barrier under tables/rails, over the native soil, to prevent splash dispersal of POD.
IX. Ensure that growing media from an outside source is known to be POD free. Potting media can be a source of contamination.
X. Mowing will take place on a sanitized tarp, outside of the nursery area, to avoid spread of possibly contaminated plant debris and build up on nursery floor

Pressure washing tray cleaner

More pressure washer photos

Steam cleaner (generator)

More steam cleaner photos (steam container)

E. Weed Control & Established Nursery Plants

GOAL: Reduce the potential for inoculum buildup of POD in weeds and established nursery plants.

I. Adequately control weeds on the nursery site as they may potentially harbor POD or insects that may spread POD.

II. Apply pre-emergent and post emergent herbicides to nursery floor as necessary.

III. Ensure nursery stock is weed free.

F. Inspection

GOAL: Regularly inspect plants in and around nursery to ensure early detection of POD infection.

I. Inspect plants weekly/daily throughout the year.

II. Monitor incoming plants, returns, or transfers for a first line of defense to ensure that potentially contaminated stock is not allowed to enter the production site.

III. Inspect high risk plants in the landscape, on growing grounds, and in surrounding areas for symptoms of POD, especially at times when symptoms are known to be most prevalent.

IV. Administer Agdia Phytophthora Immunostrip tests at least 4 times per year, even if no symptoms are observed.

V. Administer a USDA/CDFA nursery inspection no less than once every 2 years.

2) Training

A. Continuing Education

GOAL: Enhance prompt disease recognition.

a) Nursery Manager or workers are to attend California Native Nursery Network meetings when possible.
b) Educate nursery personnel to recognize and report pest or disease problems for help with early detection of POD.
c) Educate customers about our company's implemented BMPs.
d) More info is available at the USDA website http://www.aphis.usda.gov/plant_health/plant_pest_info/pram

3) External Monitoring/Audits

GOAL: Ensure earliest possible detection of POD by regularly inspecting plants in and around the nursery.

A. Regulatory Visits by CDFA/USDA

a) Visits should be done at least once every 2 years.

b) Samples of any plants with POD symptoms will be selected and tested.

c) Results are returned to Nursery Manager.

4) Testing

GOAL: Catch infections/infestations before they can spread throughout nursery.

A. Administer Agdia Phytophthora Immunostrip tests at least 4 times per year, even if no symptoms observed.

a) Test any plant material suspect of POD – in house and with CDFA/USDA. Keep any plants with symptoms separate from other nursery stock.

i) The space occupied by the tested plants should remain unoccupied until tests have been completed.

B. Results

I. Positive result

ii) If Phytophthora, confirm/consult with CDFA/USDA.

iii) Remove of entire lot of plants

iv) Test all adjacent plant lots

v) If other disease or pathogen present (not Phytophthora), review/research and make a conservative decision

vi) Properly disinfect space occupied by infected plants

b) Negative result

i) If no symptoms of POD observed on plant(s), return them to proper nursery location.

ii) If symptoms are observed and negative test comes back, continue to keep plants quarantined and send samples to CDFA/USDA.

iii) If negative result from CDFA/USDA, return to proper nursery location.

C. Record all results with date in BMPs Manual.

D. Agdia Phytophthora Immunostrip test instructions are located in Testing section of BMP binder.

E. Agdia Phytophthora Immunostrip test kits are in the refrigerator.

a. Kits expire and should be ordered at least once a year.

Agdia Phytophthora ImmunoStrip Tests (Product # 92601)

(One red line = negative, Two red lines = positive result)

5) Records/Traceability

GOAL: Keep records of incoming and outgoing plants for the purpose of identifying where plants originated and where plants have been sent in the event the nursery is found positive for POD.

A. Maintain order information for a minimum of 5 years:

a) Amount, date, species and origin, shipping address, delivery or pick up, pick up location

i) Allows protection for grower and receiver of plant material.

B. Establish a tracking system for all plants

I. Grower is to properly label all plant trays at the time of propagation with lot number and date on seed tag provided by the office, for ability to revisit lots in the future.

II. Ensure plant labels are present and visible at time of plant deliveries to Hedgerow Farms, Inc. and customers.

III. Have all customers sign packing slip provided by office, or hand written packing slip from delivery truck driver.

6) Orders

A. Pulling Orders

a) Orders shall be pulled and put into designated reserved for pick up area, located on the east side of the nursery. Plants will be placed on the pallet mounted rails.

b) Small orders can either stay in the nursery pick up area, or be brought to the table in front of the office.

B. Clean pick up location

I. Pallet rails and office pick up table will be disinfected after each pick up.

7) Trays

A. Tray return

a) Tray returns shall be dropped off near nursery and are **NOT** to be put on nursery racks/tables or pallets.

b) Trays will be picked up by grower for transport to Valley Transplant, to be cleaned. Tray cleaning info found in Section 1 (D).

B. Tray storage

c) Clean trays are to be stored on top of nursery tables/racks.

d) Any tray on the ground is considered dirty and will not be used.

8) Documentation of Program Procedures

GOAL: Provide proof that the nursery's BMPs are documented and implemented.

A. Information in the Hedgerow Farms, Inc. Best Management Practice Nursery Manual shall include:

a) Employee training records

b) List of Best Management Practices
c) Information from conferences and CNNN, research, nursery Agdia test results, general info, agency specifications, and info on other pests, pathogens, disease.
d) Nursery BMP log
    i) Agdia test dates/results
    ii) Spray/sanitization dates
    iii) Nursery Maintenance using BMPs
    iv) Hedgerow Farms, Inc. Nursery Best Management Practices List

9) **Legal Disclaimer** – provided by Best Management Practices for Phytophthora ramorum Version 1.0 binder provided by CDFA/USDA

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10) Acknowledgements/References

Many of these suggested BMPs were developed by the HRI P. ramorum industry working group, consisting of representatives from:
The Oregon Association of Nurseries
The California Association of Nursery and Garden Centers

The Horticultural Research Institute
Nursery Production businesses in California and Oregon

More BMPs were developed by:
The California Native Nursery Network (CNNN)
The Santa Clara Valley Water District (SCVWD)
The Marin Municipal Water District (MMWD)
Phytosphere Research – Ted Swiecki and Elizabeth Bernhardt
The California Native Plant Society (CNPS)
CDFA/USDA – Kathy Kosta and Karen Suslow
Yolo/Solano RCDs

Hedgerow Farms, Inc.: Nursery Best Management Practices to Follow - Aug. 2016

1. Plant propagules, including seeds, fruit, and vegetative propagules shall be free of apparent disease symptoms, including sporulation, decay, and atypical discoloration.
2. Phytosanitary procedures shall be followed when collecting seed. Seed must be placed in new bags/envelopes or clean containers.
3. Seed/fruit shall not be collected from the ground during the wet weather or under moist conditions.
4. Seed collected in bulk shall be stored and cleaned of debris before storage or stratification.
5. Plants propagated from belowground materials may harbor internal infection and shall be kept segregated in the nursery.
6. Used pots/flats must be cleaned of prior potting media and plant material and sanitized, through steam sanitization at Valley Transplant, for 30 minutes, at a temperature over 200 degrees Fahrenheit.
7. Bins for holding sterile potting media shall be sanitized before refilling.
8. Plant discards (dead plants) shall be piled down-wind of nursery to lessen possibility of spread of contamination in high winds.
9. Treat seed used for nursery stock with appropriate chemicals for disinfecting to eliminate pathogens and contaminants.
10. Tops of growing benches must be a minimum of 3 ft. to minimize the risk that water splashed from that surface will contact containers.
11. Plywood, wood pallets or similar solid surfaces that allow water to pool or run laterally are not acceptable.
12. Irrigation shall be conducted in a way to minimize splash of potting media between containers.
13. Surfaces underneath benches shall be managed to prevent puddling of water, minimize potential for splash, and remain free of weedy vegetation.
14. Clean and sanitize benches prior to placing new or sanitized pots on them.
15. Plant sakes, irrigation emitters and all other items placed on or in pots shall be new or freshly sanitized before use.
16. Items (including workers' gloves or hands) that have been in contact with the ground or other potentially contaminated surfaces or materials shall be sanitized before being placed in contact with clean plant materials, pots, soil, or benches.
17. Sanitize shoes, hands, gloves. Tools. Carts and other equipment that may serve as a source of contamination. Clothing is to be free of mud and soil.
18. Separate tools and equipment are assigned to the clean production area for exclusive use there. Tools and equipment shall be sanitized at intervals as appropriate to prevent cross contamination.
19. Plants are to be arranged with adequate spacing between pots and blocks of plants to minimize potential for cross contamination and to minimize the size of blocks that may need to be eradicated. Separation should be 1 to 2 meters.
20. Dead, dying, or poor performing plants shall be inspected and possible cause(s) shall be identified to the extent feasible.

21. Root systems of poor performing, dying, or dead plants shall be inspected for evidence of root or crown decay. If possible root decay is detected, plants shall be tested for presence of Phytophthora or other pathogens, if appropriate.
22. Dead and dying plants and any other plants with possible root disease symptoms shall be culled, tested and destroyed. The positions of culled plants on a bench should remain unoccupied at least until testing has been completed, so that spatial patterns of disease can be determined.
23. Any removal of suspected diseased or rejected plants from the clean production area must be conducted in a manner that will prevent contamination of other remaining plants. Water or potting media from removed containers shall not be allowed to fall into other containers or surfaces.
24. The bench surfaces beneath any plant testing positive for Phytophtora shall be sanitized before any other plant material is placed there.
25. Upon a single positive Phytophthora detection within a block, all pots within a 1 ft. radius of the edge of the affected container shall be removed from the block and subject to further testing.
26. Nursery shall record data and maintain records needed to verify compliance with clean production BMPs.
27. Workers shall follow phytosanitary protocols in the process of moving plant material into trucks for delivery to prevent contamination of plants.
28. Delivery truck/trailer shall be sanitized, before loading plants for delivery, with 70% ethyl or isopropyl alcohol.
29. Water: tests and documentation. Done monthly or bi monthly at Valley Transplant.