Nursery Industry of California
Best Management Practices Program

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WHAT ARE BEST MANAGEMENT PRACTICES?

- Basic, common sense practices previously known by most of us as good phytosanitary measures and methods.

WHO COMPILED THIS LIST OF BMPS?

- Members of industry, state departments of agriculture, university, federal agencies, scientists, among others, have compiled the best management practices deemed essential in the production of healthy nursery stock. They have been reviewed, revised, rewritten and revisited again. Not set in stone and open for additions, revisions, or deletions, this set of BMPS is a fluid document. Intended to be adaptable to the various nursery settings.

Primary Collaborators

- ANLA/HRI
- CANGC
- OAN
- WSNLA
- CDFA
- ODA
- WSDA
- Nursery Operations
- Land Grant universities
- USDA – APHIS
- USDA – ARS
- National Plant Board

Recommended Best Management Practices (BMP) for the prevention of *P. ramorum* introduction or establishment in Nursery operations

- Developed using NAPPO RSPM 24
- Reviewed by researchers, regulators and industry in multiple states
- Based on best available science
- Collaborative development & ‘vetting to industry’
- Weighted focus on High Risk plants

What is driving the demand to implement “a clean stock program”?

Drivers in This Process

- Continued disease presence
- Protection of the natural ecosystem
- Protection of the nursery industry
- Regional concerns – CA,OR,WA
- National concerns – NPB
- Bilateral (US – Canadian) trade

WHO IS USING BEST MANAGEMENT PRACTICES?

In a survey of the 350 growers of hosts and associated plants, 232 indicated that BMPs were already in use.

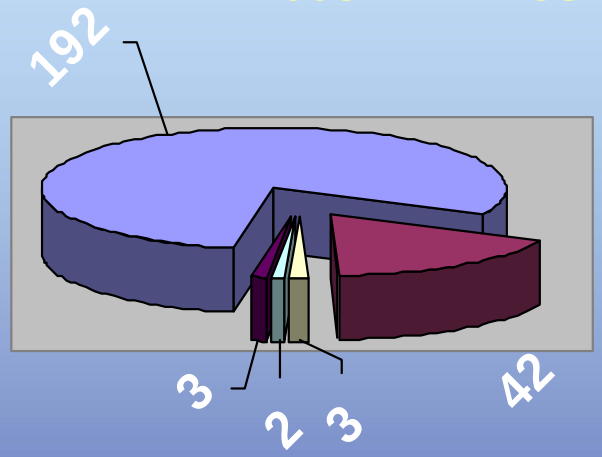
WHO IS USING BEST MANAGEMENT PRACTICES?

In another survey of the 107 growers of high risk hosts, 80 indicated that BMPs were already in use at their nurseries.

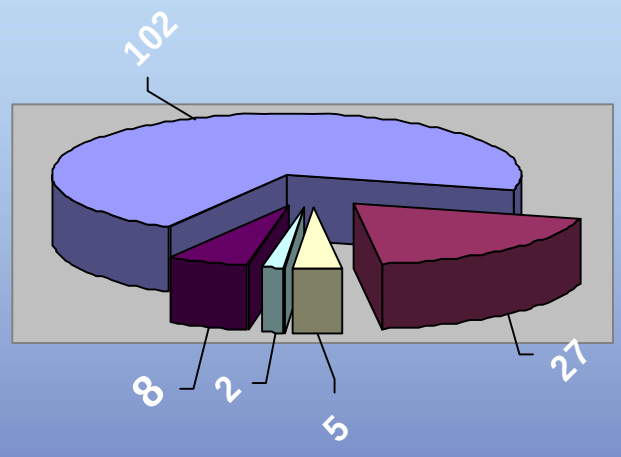
What are “High Risk Plants”?

Camellia | Rhododendron | Pieris | Viburnum | Other

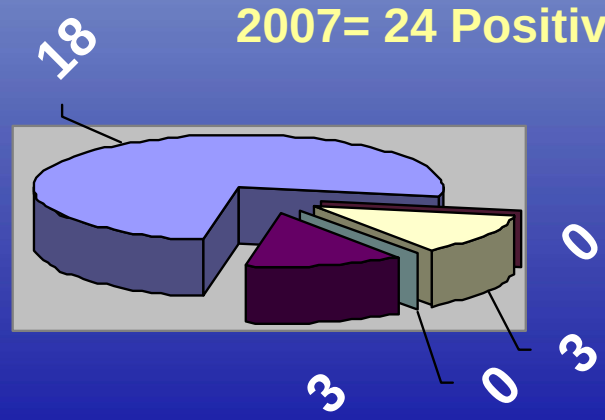
2005= 242 Positives



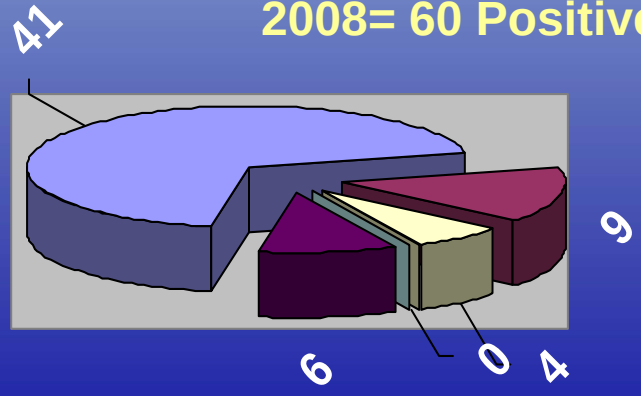
2006= 144 Positives



2007= 24 Positives



2008= 60 Positives



Components of BMPs

- Prevention/Management
  - Moisture management
  - Nursery layout
  - Cleaning and Sanitation
  - Weed control and established nursery landscape plants
- Training
- Internal/External Monitoring/Audits
- Records/Traceability
- Documentation of Program procedures

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Regulated

Site Specific rBMP

☐ ☑

Avoid or minimize accumulation of standing surface water in containerized high-risk plant beds.

Rationale:

- *Phytophthora spp. are transmitted via water and repeat finds occur more often in high-risk plant beds where standing water accumulates.*

- *The pathogen may potentially enter either through the roots or by splashing onto leaf surfaces*

Requirement for External Audit:

- *Documentation of irrigation practices.*

Regulated

Site Specific rBMP

☐ ☑

Avoid overhead irrigation of high-risk plants. Irrigate in a manner to avoid prolonged leaf wetness of 12 hours or more.

Rationale:

- *Properly time irrigation events to reduce conditions favorable for disease development.*

- *Extended leaf wetness (such as overnight) is conducive to pathogen infection.*

Requirement for External Audit:

- *Documentation of irrigation practices*

Regulated

Site Specific rBMP

Irrigation water from any source other than well or municipal water supplies shall be monitored and tested to confirm that it is free from the pathogen.

Rationale:

- *For growing operations that utilize open irrigation water sources (ponds, lakes, streams), and/or who blend both well and surface water sources for irrigation purposes, proper water treatment, such as ozonation, chlorination, filtration or other water disinfection program is recommended.*
- *Attention also needs to be directed to possible well water contamination with the P. ramorum pathogen by back siphoning of irrigation water or water/soil into the system.*

Requirement for External Audit:

- *Documentation of water sources*

Regulated

Site Specific rBMP

Divert soil and water movement during storm-related events from hillsides populated with *P. ramorum* host plants.

Rationale:

- *Keep possible offsite contamination from entering production location.*
- *Unless the offsite area has been properly surveyed and determined to be P. ramorum free, the grower cannot assume that run-off from offsite is not contaminated with P. ramorum spores.*

Requirement for External Audit:

- *Nursery site inspection*

- Assess the risk
- Review it with your third-party auditor
- Do not implement a program that unknowingly increases your risk

Risk awareness is critical !!!

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Regulated

Site Specific rBMP

Review your Field Layout Plan. Determine how you can minimize the impact of the USDA Confirmed Nursery Protocol if *P. ramorum* is found. Break up long sections of host and associated host plants (HAP) with non-HAP material to the genus level.

Rationale:

- *Nursery production bed layout, mixing or alternating of HAP and non-HAP plant material in production beds can help eliminate large contiguous monocultures of plants that are P. ramorum susceptible.*

Requirement for External Audit:

- *Mapping of stock location*


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Regulated

Site Specific rBMP

Reduce inoculum splash from heavy sporulating HR plants, Camellias and Rhodys, to all other crops.

Rationale:

- *These two HR genera are prolific sporulators and are in association with infected plants at a frequency rate of 88%*
  (See High Risk Proposal)
- *Space All plants a minimum of 2 meters from HR plants or*
- *Create a physical barrier between HR plants and all other crops or*
- *Apply preventative fungicide to HR crops throughout the growing season or*
- *Intersperse HR plants with 2 meters of resistant plants, e.g. grasses, Buxus sempervirens*

Requirement for External Audit: *Nursery site inspection*

Regulated

Site Specific rBMP

Maintain a separate cull pile for HR plants so they are not included in the soil recycling pile for potential future reuse. If infested plants are found, the pile must be quarantined and treated, or disposed of, according to regulatory requirements.

Rationale:

- *Proper sanitation measures reduces the risk of spreading the pathogen in the recycled soil within the nursery.*

Requirement for External Audit:

- *Nursery site inspection*

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Regulated

Site Specific rBMP

After every crop rotation, disinfect propagation mist beds, sorting area, cutting benches, machines and tools to minimize the spread or introduction of pathogens

Rationale:

- *Basic sanitation practices should be followed using registered fungicides in accordance with label instructions to reduce possible points of entry/contamination in the production cycle.*

Requirement for External Audit:

- *Documentation of nursery personnel training*

Regulated

Site Specific rBMP

Use new or clean and sanitized pots for high-risk plant production.

Rationale:

- *This measure reduces the potential of any unknown residual P. ramorum contamination on the nursery site and possible further dissemination of the pathogen throughout the nursery*
- *New pots should be stored and handled in such a manner as to avoid contact with potential P. ramorum sources.*
- *Recycled pots should be thoroughly cleaned of any residual substrate and disinfected before reuse. Recycled pots should also be stored and handled in such a manner as to avoid contact with P. ramorum sources.*

Requirement for External Audit:

- *Documentation of nursery sanitation practices*

Regulated

Site Specific rBMP

Ensure runoff from all cull piles is directed away from soil components, soil mixing area, and growing beds to prevent contamination.

Rationale:

- *Avoids any possibility of cross contamination. If growers cull infested material, sanitation methods should be established to clean/disinfect trucks, wagons, and tools that are used to move infested material.*

Requirement for External Audit:

- *Nursery site inspection*

Regulated

Site Specific rBMP

For plants that are prone to disease, chemically treat crop in field prior to taking cuttings and dip cutting in an approved disinfectant solution before sticking.

Rationale:

- *Treatment of stock plants with registered fungicide(s) before cutting of the propagation material can reduce the possible introduction of contaminated plant material into the propagation cycle and protect the open wounds from possible pathogen infection.*

Requirement for External Audit:

- *Nursery pesticide application reports*

Regulated

Site Specific rBMP

If you visit known *P. ramorum* infested areas, wash shoes, tools and vehicles that may have contacted contaminated soils before traveling to disease free areas.

Rationale:

- *Best defense is to not visit areas where known infestations are occurring to reduce accidental introduction of the pathogen into the nursery production site.*
- *If grower has visited infested areas, appropriate sanitation measures (washing and steam cleaning of trucks, etc.) as recommended by regulatory authorities should be undertaken*

Requirement for External Audit:

- *Documentation of nursery sanitation procedures training*

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Regulated

Site Specific rBMP

☐ ☑

Manage weeds on the nursery site because some can serve as alternate hosts for *P. ramorum*.

Rationale:

- *Maintaining clean cultivation in and around the production site may eliminate possible reservoirs of P. ramorum pathogen.*
- *Since it is not known if insect vectors can also carry P. ramorum, clean cultivation will reduce opportunities for insect infestations and contamination in the nursery.*

Requirement for External Audit:

- *Nursery site inspection*

Epilobium angustatum

Regulated

Site Specific rBMP

No over story or under story of known *P. ramorum* hosts on nursery growing ground should be maintained unless regular monitoring of those hosts is performed.

Rationale:

- *Reduce the potential of offsite contamination of P. ramorum into the production site by establishing a regular monitoring program for P. ramorum host plants in the environs of the nursery.*

- *Monitoring program should be based upon the specific life cycle of the disease within that specific growing region and the time of year when the pathogen is most prevalent.*

Requirement for External Audit:

- *Nursery site inspection*

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Regulated Site Specific rBMP

Educate nursery personnel to recognize and report pest or disease problems.

Rationale:

- *Personnel should be trained to not only look for P. ramorum symptoms but for any symptoms of plant abnormality in the production system.*

Requirement for External Audit:

- *Documentation of training*

Regulated

Site Specific rBMP

Nursery personnel should attend one or more *P. ramorum* trainings conducted by qualified personnel or document self training via one of the two websites below.

Rationale:

- *Responsibility for P. ramorum management on nursery site should be the responsibility of a specified group of trained nursery personnel. These individuals should be trained in all aspects of the management of the disease.*
- *Special attention should be given to staying informed of new research findings regarding the disease and any changes in regulations regarding plant sampling, testing or shipping of product.*
- *Training is available through the USDA, US Forest Service, CA Oak Mortality Task Force, state agriculture department, county agricultural commissioners offices or through selected universities.*

Requirement for External Audit:

Documentation of training

USDA website:
www.aphis.usda.gov/ppq/ispm/pramorum
COMTF website:
www.suddenoakdeath.org

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Regulated

Site Specific rBMP

Annual nursery inspection of all plants in the nursery with a focus on *P. ramorum* like symptoms. Inspection of HAP shippers includes mandatory testing of at least 40 symptomatic samples.

Rationale:

- *The host list continues to expand and as a result, all plants need to be inspected for P. ramorum-like symptoms.*
- *State and federal regulation require a minimum of 40 samples to be taken and tested.*

Requirement for External Audit:

- *Annual nursery inspection report*

Regulated Site Specific rBMP

Nursery to inspect high-risk plants, such as Rhododendron and Camellia, monthly throughout the growing season.
Train employees to look for and report symptoms when working with the HR plants.

Rationale:

- *Camellia and Rhododendron species have comprised the majority of the total positive plants in nursery settings throughout the regulated area.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Routinely* inspect HAP on growing grounds and in the surrounding area for symptoms of *P. ramorum*. Implement appropriate testing and sanitation practices (particularly after pruning or significant weather events).

Rationale:

- *As part of the normal production cycle, HAP plant material should be visually screened on a regular basis for any abnormalities.*
- **Special attention should be given to those times during the production cycle when the pathogen is most prevalent.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Routinely monitor incoming (buy-ins, transfers ….) HAP for symptoms of *P. ramorum*

Rationale:

- *First line of defense. Growers priority should be to ensure that potentially contaminated stock is not allowed to enter the production site.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Ensure the use of *P. ramorum* free growing media/growth substrate.

Rationale:

- *Since P. ramorum may contaminate potting substrates, it is critical for the grower to reduce any sources of contamination in peat, bark, and other organic components of the substrate.*
- *Proper documentation of disease free substrate materials shipped into the site should be obtained.*
- *Proper storage and prompt use of substrate materials is critical.*

Requirement for External Audit:

- *Documentation of nursery practices*

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Regulated

Site Specific rBMP

Confirm nursery stock is propagated from materials obtained onsite, or is received from nurseries that are licensed and/or certified according to all applicable phytosanitary laws and regulations

Rationale:

- *First line of defense. Know your supplier. Grower priority should be to ensure that potentially contaminated stock is not purchased or allowed to enter production site.*

Requirement for External Audit:

- *Documentation of nursery practices*

Avoid product returns of nursery stock from a receiver in a quarantined area or from nurseries that are not under *P. ramorum* compliance. If unavoidable, contact your county agriculture department or appropriate regulatory agency prior to accepting the nursery stock return.

Rationale:

- *Avoids possible cross contamination.*
- *Returned nursery stock may have been exposed to P. ramorum prior to return.*

Requirement for External Audit:

- *Nursery map*
- *Documentation of nursery practices*

If possible, nurseries should avoid commingling incoming HAP nursery stock with existing stock.

Rationale:

- *Avoids cross contamination of clean and potentially diseased material.*
- *Assists with inventory control and tracking of plant material in the nursery.*

Requirement for External Audit:

- *Documentation of nursery practices*
- *Nursery site inspection*

Regulated

Site Specific rBMP

For HAP buy-ins, suspend the use of Phytophthora specific fungicides on 10% or 100 plants, whichever is fewer, for a two month period to determine if fungicides that may have been used by the seller were masking symptoms of *P. ramorum* or, through your state agricultural department, sample and test a representative group via ELISA or PCR. If tests are negative, the BMP is not applicable.

Rationale:

- *This recommendation correlates with avoiding the commingling of incoming HAP and supplements isolation efforts.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Off load incoming high-risk plant shipment to an area that can be cleaned of leafy debris. Sweep incoming plant debris from the receiving area and the delivery truck, collect debris and dispose of appropriately.

Rationale:

- *Basic sanitation to remove possible sources of disease inoculum.*
- *Proper disposal of leafy debris should be governed by appropriate local/state/federal recommendations (bagging, burning, burying offsite, etc.).*
- *Composting of infected plant debris is not an acceptable practice. Leaf litter has been shown to be a potential source of inoculum.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Monitor sanitation practices of delivery trucks that ship high-risk plants. Assure that trucks are properly cleaned of plant debris between shipments.

Rationale:

- *Trucks may be a source of inoculum if not cleaned properly.*

Requirement for External Audit:

- *Documentation of nursery practices*

Regulated

Site Specific rBMP

Maintain for two years minimum: accurate shipping documentation identifying product, amount, date and origin or receiver for the purpose of identifying trace backs and trace forwards.

Rationale:

- *Proper documentation protects not only the grower but also the receiver of plant material.*
- *Production operation should investigate methods for quick recording and retrieval of documentation.*
- *Disease monitoring and scouting results should be integrated with inventory control to provide rapid trace forward and back of suspected infested nursery stock.*

Requirement for External Audit:

- *Nursery records inspection*

Regulated

Site Specific rBMP

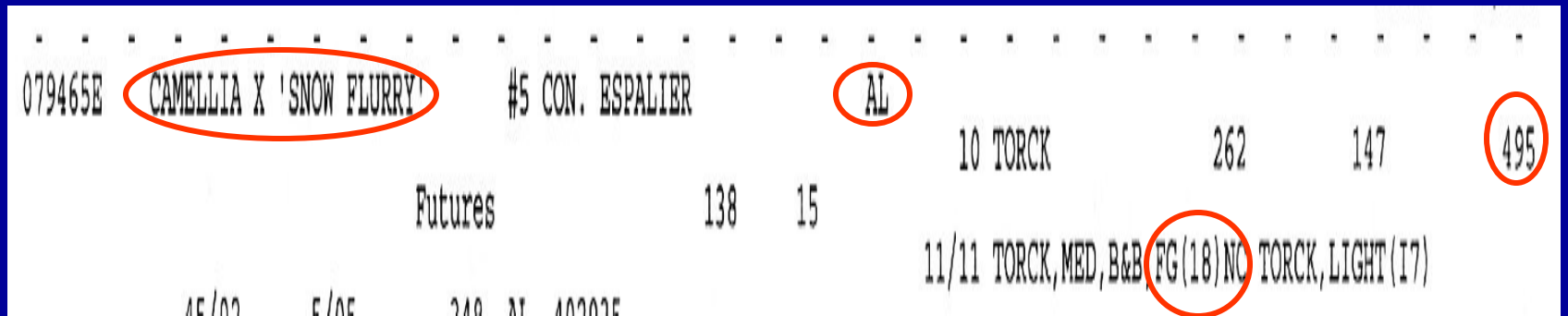
Consider strategies that would facilitate the rapid identification and segregation of product based upon production location from the time it has left the growing operation through final sale.

Rationale:

- *Operations personnel should develop a "Code Red" crisis management plan for dealing with possible P. ramorum infestations that stresses containment and considers all aspects of the plant production cycle, but especially the movement of plant material around site and shipping offsite.*

Requirement for External Audit:

- *Written nursery "Code Red" plan*



Regulated

Site Specific rBMP

Authorized and knowledgeable personnel should visually inspect all nursery stock (buy-ins, transfers, and returns) regardless of origin, for symptoms of *P. ramorum* prior to introduction into the nursery facility.

Rationale:

- *Since not all areas of the country can be certified P. ramorum free, this visual evaluation of offsite nursery stock can provide a major screening defense to the introduction of the pathogen.*

Requirement for External Audit:

- *Documentation of nursery personnel training*
- *Documentation of nursery practices*

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BMP #1a Addendum
Overhead watering of HR plants
If a practice is changed, update this addendum

- ☐ **Overhead irrigation not used**
- ☐ **Overhead irrigation:**
  - ☐ **Time irrigation early enough to allow for leaf drying**
  - ☐ **Circulation fans used**
  - ☐ **Plant spacing is adequate and allows for foliage to dry within 12 hours**
  - ☐ **Other method used to minimize leaf wetness, (explain) _____**

_____ initial and date

Thanks to many, especially…

Amber Morris, CDFA, &
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