



Canadian *P. ramorum* Nursery Certification Program

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1.0 Introduction

The following document outlines the standards required for *Phytophthora ramorum* (Sudden Oak Death) Certification in Canada. This document will hereafter be referred to as the Standard. This is a program to control the spread of *P. ramorum* in the Canadian nursery industry and in the Canadian environment.

Notice:

Implementing the actions that are outlined in this Standard will reduce but not eliminate the risk of *P. ramorum* being established or found on plants at your nursery. This certification system **CANNOT GUARANTEE FREEDOM FROM *P. ramorum* disease.**

This program is accredited by the Canadian Nursery Certification Institute (CNCI) with program services provided by designated administrators in Canada.

The objective of a *P. ramorum* certification program is to:

1. Keep Canada open for trade in nursery products.
2. Reduce the likelihood of introduction, establishment and spread of *P. ramorum* into the nursery and throughout nursery industry and associated industries of garden retailers and the landscape trade.
3. Reduce the risk of spread of *P. ramorum* from the nursery into the Canadian environment.
4. Show due diligence by the nursery production facility proving that best efforts have been made to reduce the risk of *P. ramorum* spread.
5. Meet or exceed the requirements of a *P. ramorum* pest free place of production (as per pest free place of production defined under ISPM 10 and CFIA policy D-01-01).

There are four key elements to *P. ramorum* certification:

1. Prevention of the disease from entering the facility.
2. Evaluation of the facility by annual *P. ramorum* sampling and testing of host plants as well as visual inspection of non-host plants¹. Test results must be negative for *P. ramorum* for a nursery to participate in this *P. ramorum* Certification Program. This element is waived if the following

¹ Where non-host plants show symptoms of *P. ramorum*, samples should also be taken for *P. ramorum* testing.

two requirements are consistently met: 1) two consecutive years of negative testing results and 2) successful completion of an annual third party audit

3. Timely preparation and annual update of a Nursery Manual
4. Verification that operations are compliant with processes as described in a signed Canadian *P. ramorum* Certification Standard by an independent third party audit.

1.1 Summary of Application Process

To become a *P. ramorum* certified nursery, the facility must:

1. Be a greenhouse or nursery operation located in Canada.
2. Complete and sign an Application form (Appendix I).
3. Implement the conditions of the *P. ramorum* Certification Standard,
4. Document and implement all mandatory practices and biosecurity measures as designated in this Standard and outlined in the Nursery Manual
5. Sign a *P. ramorum* Certification Compliance Agreement (Appendix II) that confirms the implementation of this Standard at the certified nursery.
6. Training: The Administrative Manager and the Implementation Manager must watch the *P. ramorum* Certification Workshop DVD and pass the open book examination. Although not mandatory, it is highly recommended that the Internal Auditor also watch the *P. ramorum* Workshop DVD.
7. Up-to-date program information and documents can be found on the CNCI Website at www.cleanplants.ca.

1.2 Timelines for *P. ramorum* Requirements to be Completed for New Registrants

- The Registration Form and Compliance Agreement must be completed and signed upon application into the program
- The Workshop DVD must be purchased upon application. The examination (open book) must be written and passed by the *P. ramorum* management prior to Certification
- Sampling and testing and/or a visual inspection may be conducted congruently or at a subsequent time when appropriate (plants need to be in leaf)
- The facility must have negative results from the sampling and testing and all invoices must be paid prior to Certification
- A Nursery Manual must be submitted and approved within 90 days of your nursery being listed on the *P. ramorum* website

- Changes to the geographical locations of production or the conditions under which a nursery is Certified must be communicated to the CNCI Administrator in a timely manner before an external audit so that adjustments can be made in the Compliance Agreement and subsequent sampling and testing requirements if applicable (see Appendix III for more details)
- A training (or soft audit) will be conducted at the nursery within one calendar year of the Nursery Manual approval. Nursery stock will be Certified up to December 31st of the following year after the above requirements are completed.

2.0 Responsibilities of Management and Key Personnel

Facility management is defined as follows:

Administrative Management:

- Administrates the record keeping, inventory management, and plant traceability
- Ensures that all documentation is properly kept for internal and external audit
- Develops a program for their nursery production facility that meets the standards outlined in the signed *P. ramorum* Certification Compliance Agreement
- Oversees the preventative and corrective actions that are identified by internal or external audits or brought to the attention of the administration manager by other channels
- Reviews and verifies that the system is working once it is up and running
- Ensures that the certified facility has in its employ sufficient competent staff to carry out the requirements of this Certification Standard

The Administrative Manager of the nursery facility must ensure that all elements of the signed *P. ramorum* Certification Compliance Agreement have been implemented, that internal audits are in place and that needed corrective actions are carried out immediately.

Implementation Management:

- Implements all elements of the plan that pertain to the facility operations are in place and monitors these elements on a regular basis. (This refers to the day-to-day activities.)
- Initiating preventative and corrective actions (on an ongoing basis)
- Note that in some operations, the Administrative and the Implementation Managers may be the same person.

Internal Self-Auditor:

- a) The purpose of the internal self-auditor is to verify that the processes and biosecurity measures outlined in the approved Nursery Manual have been correctly implemented.
- b) The Administrative Manager shall designate the internal auditor. (This person may be an outside contractor.)

3.0 Requirements for Maintaining *P. ramorum* Certification

See 1.1 Summary of Application Process for the steps to become *P. ramorum* certified.

3.1 Initial Inspection of the Nursery Facility

In order to maintain a certified status after acceptance into the *P. ramorum* Certification system, a Certified nursery must complete the following:

- For each of the first two years on the program, the nursery facility must be sampled and tested for *P. ramorum* by CFIA or the CNCI authorized designates with test results showing no positive findings for *P. ramorum*. Recognizing that CFIA conducts annual surveys for *P. ramorum* as well as other testing, the results of CFIA surveys and testing may be recognized by CNCI in lieu of sampling and testing by CNCI designates.
- Visual inspections of non-host material is an integral part of the accreditation process and is presently only available through the CNCI or its designate (not the CFIA) unless otherwise approved.
- Sign a Compliance Agreement
- Submit the Nursery Manual for approval. The Nursery Manual must be completed using the approved Nursery Manual Template.

3.2 Implementation of Mandatory Best Management Practices

- Implement Mandatory Best Management Practices as outlined in this Standard and documented in your Nursery Manual

3.3 Internal and External Audits

- Conduct two internal audits annually by completing Template III ‘*P. ramorum* Compliance Checklist for the Internal Self Audit’ (see Nursery Manual Template).
- Participate in an external audit annually.
- Attend workshops and information sessions when required

4.0 Record Keeping and Traceability

Good record keeping enabling efficient traceability is one of the most critical aspects of *P. ramorum* certification. Records shall be kept for a minimum of seven (7) years.

If a nursery is implicated in a *P. ramorum* positive, whether by trace-out or by the national survey, good record keeping can:

1. Protect your nursery by identifying movement of suspect material.
2. Allow the focus of resources on specific areas where *P. ramorum* infected plants have been produced within your nursery rather than applying resources to the entire nursery production area.
3. Provide proof of due diligence with respect to movement of *P. ramorum* infested material within the nursery.
4. Allow identification of high risk areas so that nursery personnel can apply appropriate sanitation procedures that will reduce the risk of areas of the nursery retaining sources of inoculum and thus re-infesting the nursery.
5. Assist in a trace-out investigation, if required.

All *P. ramorum* Compliance Agreements, a copy of this Standard ² and any associated written procedures and Nursery Manuals developed by the facility, shall be available to nursery staff, internal auditors and external auditors to ensure knowledge and compliance.

The Nursery Manual is to be prepared using the *P. ramorum* Nursery Manual Template. Additional growing sites and major updates or changes of procedures must be documented in the Nursery Manual at least one month before an external audit. Adding High Risk genera to the plant inventory at the Certified Nursery must be documented in the Nursery Manual and submitted to the program administrators.

An up-to-date map shall be kept that shows the locations of all production areas on the nursery. This map is for reference purposes and must be available to staff and auditors.

- Keep records for seven years
- Must have Compliance Agreement and Nursery Certification Manual ready for inspection
- An up-to-date nursery map showing production areas must be available

² The Canadian *P. ramorum* Nursery Certification Standard will be updated based on current knowledge of *P. ramorum* and the resulting changes in requirements. For the current version of the Standard, go to www.canadanursery.com (click on Nursery Programs) or www.cleanplants.ca (click on *P. ramorum*) to access the latest version.

4.1 Verification of Internal Plant Movement and Monitoring

Records of the movement and monitoring of plant material shall be maintained.

The purpose of record keeping is to:

- Demonstrate the origin of plants or parents of plants (where the plants were grown or propagated).
- Locate production blocks within the nursery.
- Locate plants within the facility (last production location before shipping)
- Confirm that the monitoring program for *P. ramorum* symptomatic material is consistently implemented

4.2 Incoming Plants

Records shall be kept such that the audit can ensure that all new plants meet the requirements of this Standard. Records³ must include the following:

- | |
|---|
| <ul style="list-style-type: none">• Keep records of incoming plants |
|---|

1. Source of plants (supplier name and nursery location)
2. *P. ramorum* Certification status of plants
3. Name and description of plants
4. Date of receiving
5. Copies of the Phytosanitary Certificates for imported plant material
6. Date of visual inspection at receiving, name of person conducting inspection and inspection results

Additional Record Keeping Requirements for Host Plants from Non-*P. ramorum* Certified Nurseries:

1. Records must be kept for *P. ramorum* host plants placed in isolation blocks for sampling and testing, as per Section 5.2 of this Standard
2. Sampling and testing records of plants held in isolation must be maintained

4.3 Plants Received for Immediate Resale

Plants for immediate resale must have originated from facilities that have been Certified under recognized *P. ramorum* certification programs recognized by CNCI or CFIA to be sold as '*P. ramorum* Certified'.

³ Records can be a combination of pick slips, supplier delivery slips, or invoices

Plants originating from non-certified sources (other than pest-free areas) brought in for immediate re-sale cannot be sold as *P. ramorum* certified. In order for these plants to become *P. ramorum* certified, they must meet the requirements outlined in Section 5.2. If these certification requirements are not met, uncertified host plants must remain segregated in the shipping area, be prevented from moving into any production area in the nursery, and clearly identified on shipping and invoicing records as non-certified when resold. Records of purchase and sale must be kept as described in Section 4.2.

Plants will be considered as plants for resale until such time that they have moved from the shipping area into the production facility. Once the plants enter the production facility they must follow criteria outlined in this Standard.

The shipping area is defined as a place where plants are collected for outgoing shipments, or received from incoming shipments, and which is separated from the production facility by a barrier at least .5 meters (50 cm) higher than the highest plant adjacent, or by a 2 meter vegetation-free buffer.

4.4 Outgoing Plants

Records⁴ shall include:

- Name and description of plants
- Last growing location prior to movement to the shipping area. This can be recorded in a variety of ways such as notation on the pick or pull slips, notation in an electronic inventory system, or another commonly used shipping document or system.
 - In the event that plants produced at your nursery are found to be positive for *P. ramorum* after sale, CFIA will need to examine the growing location (field or container bed) where the infected plant was produced. If the growing location has been documented, the growing block can be quarantined (all sales stop) while sampling and testing proceed. If the growing location is not documented or unknown, the entire nursery may have to be quarantined until the investigators deem the site free of *P. ramorum*.
- Destination of plants
- Date of shipment
- Record of final visual inspection at shipping, signed or initialled and dated by person carrying out inspections of outgoing plants
- Copy of Phytosanitary Certificate, for exported plants

- Keep records of outgoing plant shipments

⁴ Note that any in-house record (records) that records the information listed above can be used (order book, pull sheet, pick slip, invoice). Not all of the information needs to be on the same record, but the auditor must be able to access all of the information listed above in your record keeping system

4.5 Spray Records

Spray records of all fungicides applied within the nursery must be recorded. Records must be kept as per provincial or federal regulatory agency requirements.

4.6 Soilless Media, Organic Mulches and/or Soil

Records shall be kept on all incoming shipments of soilless media, organic ingredients used to make soilless media, organic mulches and soil. Delivery memos or invoices are sufficient.

- Keep records of media and ingredients purchases

4.7 Records of Visitors

It is recommended that records of visitors to the nursery site be kept. See Section 5.9 for more details.

5.0 Preventing the Introduction and spread of *P. ramorum*

Participants in the *P. ramorum* Certification program agree to develop a systems approach to prevent the introduction of *P. ramorum* into their nursery. The critical pathway by which the nursery industry can potentially spread *P. ramorum* is through the movement of infected plants. This standard addresses this critical pathway by requiring that certified nurseries do the following:

The #1 most effective risk management tool nursery growers have is to ensure that their incoming stock is clean and that all debris from the delivery truck is disposed of off-site.

*Once on-site, *P. ramorum* is extremely difficult - and expensive - to eradicate.*

5.1 Plants from *P. ramorum*-Certified Nurseries

A *P. ramorum*-Certified nursery shall purchase plants from:

1. Sources which participate in a Certification program approved by the CNCI, or
2. Nurseries under a Certification program approved by CFIA
3. *P. ramorum*-free areas accompanied by a phytosanitary certificate, or
4. Any domestic regions deemed by CNCI to be of low risk

It is recommended that each supplier should provide evidence for each received shipment, that BMP's⁵ have been implemented at each production site listed in the supplier's Nursery Manual.

NOTE: All Canadian nurseries certified in the *P. ramorum* Certification Program are listed on www.cleanplants.ca and www.canadanursery.com.

If incoming plants originate from approved *P. ramorum*-Certified suppliers or from nurseries in regions where *P. ramorum* is not known to exist:

- Upon visual inspection, being found 'clean', they may be placed into a *P. ramorum*-certified area of the nursery
- If host plants are found with visual symptoms resembling *P. ramorum*, their treatment should be outlined in the Nursery Certification Manual. This could include refusing the shipment, immediate destruction, sampling and testing, isolation, etc.

Note: Propagation of plants in a *P. ramorum* certified nursery must be from *P. ramorum* Certified stock.

⁵ Best Management Practices

5.2 Plants from non-*P. ramorum* certified Nurseries

5.2.1 Host Plants (High and Low Risk):

All host plants (high risk and low risk) not purchased from facilities described in Section 5.1 are considered to be plants from a non-certified facility. Non-certified host plant purchases must be placed in the isolation area prior to entry into the production areas.

The following steps must be taken before non-certified host plants can enter the production areas of the facility:

1. Incoming non-certified host plants (high risk and low risk) must be placed in a designated isolation block⁶ until confirmation of negative results from sampling and testing for *P. ramorum*. This block must be clearly shown on the nursery site map.
2. Designated isolation blocks must be kept separated from other plant material by a minimum of 2 meter buffer zone (canopy to canopy). Buffer zones shall be maintained free of all vegetation, including weeds. A sealed poly house, where there is a 2 meter vegetation free buffer from any opening to the nearest plant, can be used as an isolation area. If the sides of poly houses are rolled up or cut out, the 2 meter vegetation free buffer 'canopy to canopy' will apply.
3. Plants will be sampled by trained (in house) samplers using the sampling protocols recognized by the CNCI. (See sampling protocol listed in Appendix IV.)
4. Biosecurity measures must be implemented to limit the possibility of *P. ramorum* spread from the isolation block to other production areas of the facility (See Appendix VII for biosecurity measures.).
5. Plant must not be sprayed with fungicides while in the isolation area (See Appendix VIII)
6. Plants will not be sold or moved until negative *P. ramorum* sampling results have been received in writing from a CNCI designated laboratory. Negative ELISA test results will be considered negative for *P. ramorum*. If ELISA tests are positive, then the subsequent PCR tests conducted by a CNCI designated laboratory (or alternate test as determined by the CNCI) must show negative results.

All host plants (high and low risk) from non-certified nurseries must be isolated, then sampled and tested prior to movement into regular production area.

Further BMP's for host plants from non-certified sources must be followed.

NOTE: If samples are positive for *P. ramorum*, the CNCI designated laboratory will immediately notify CFIA.

⁶ The isolation block must be labelled on the nursery map. However, it must only be organized and maintained as per the requirement listed in Section 5.2.1 above when the isolation area is required to Certify non-certified plants.

5.2.2 Non-Host Plants:

Before being placed into production blocks, non-host plants must be inspected and found free of visual symptoms of *P. ramorum*. When plants have *P. ramorum*-like symptoms, procedures outlined in Section 5.4 of the Nursery Manual must be followed. Procedures may include: refusal of the plant material (returned to supplier); immediate disposal off site; or containment in the isolation area and subsequent sampling and testing. See Appendix V for more details.

5.3 Plants from Canadian Wild land Sources: (where *P. ramorum* is not known to exist)

The *P. ramorum* Certification program is designed to minimize the risk of moving *P. ramorum* spores from one area to another. At the present time, all detections have been related to the commercial nursery system of moving plants or plant parts. Therefore the purpose of this section is to limit movement of plant material, which has had access to commercial sources, into the wild, and then to be collected and returned to nursery production.

Example: taking plants or plant parts from berms adjacent to your nursery would not be considered ‘taking from the wild’.

‘The wild’ is considered to be any place where there is a reasonable expectation that the plants have not been introduced, nor have they had been exposed to the risk of pests or diseases from commercial nurseries. As *P. ramorum* is not known to exist in the wild in Canada, plants may be sourced from the natural setting under the following conditions.

Plants or plant parts from Canadian wild land sources can be assumed to be low risk (can enter Certified production areas after a visual inspection) if the following conditions apply:

1. When gathering scion wood, seed and plant materials from the wild, plant material must not be obtained from areas where plants have been introduced by people.
2. When scion wood, seed and plant materials are gathered from progeny trials, plant banks or seed orchards the plants and plant parts are considered low risk.

Plants must be visually inspected for *P. ramorum* symptoms prior to harvest (removal of plant parts) and monitored during propagation and production.

sampling and testing or bagging and removing the plants off site for disposal.

5.7 Plants for Immediate Resale

All host plants received for immediate re-sale must have originated from a recognized *P. ramorum* Certification Program or a *P. ramorum*-free place of production (See Section 5.1 for list) in order to be included under the *P. ramorum* Certification Program.

Plants for immediate resale that do not originate from a recognized *P. ramorum* Certification Program or a *P. ramorum*-free place of production cannot be sold as *P. ramorum* certified under this program. These plants must be clearly identified on shipping and invoicing records as non-certified.

1. Records of purchase and sale must be kept as described in Section 4.2.
2. Plants that originate from a non-certified nursery entering the shipping area of a *P. ramorum* Certified nursery which are then immediately re-shipped (and have not entered the production area) cannot be sold as *P. ramorum* Certified stock. Non-certified plants must remain segregated in the shipping area until shipped out.
3. If uncertified plants brought in for immediate re-sale are not sold, they may enter the facility as per requirements in Section 5.2.

Plants will be considered as plants for resale until such time that they have moved from the shipping area into the production facility. Once the plants enter the production facility they must follow criteria outlined in this Standard.

5.8 Nursery Production Practices (BMP's⁷) which Reduce Risk of *P. ramorum* Spread

As the science of *P. ramorum* becomes better understood, mandatory and recommended production practices may change. These 'Best Management Practices' (BMP's) are based on the known science at the time of writing. See Appendix VI for more details.

Mandatory Nursery Production Practices for All Host Plants:

All appropriate staff must be trained regarding the risk of spore movement by staff, equipment and plants around the nursery.

⁷ Best Management Practices See Appendix V for more details.

5.8.1 All Host Plants

Highly recommended practices for all host plants are:

1. For all Host genera, an Integrated Pest Management (IPM) Program should be developed to help minimize the risk of spore movement and to minimize spore transfer if an infected plant is unknowingly brought into the nursery. The IPM program should take into account the risk of infection, based on plant source, rainfall, irrigation practices, type of plants, etc., and may include the application of fungicides.
2. Host plants should be grown in areas with minimal standing water or puddling.
3. Leaf litter and other plant debris should be controlled to reduce inoculum levels. A policy for maintenance and cleaning of nursery beds and shipping areas should be in place.
4. Movement of staff, equipment and plants should be managed to minimize potential spore movement within the nursery.
5. If a suspect positive is found by CNCI authorized testing on a facility but cannot be confirmed by CFIA, it is strongly recommended that the nursery should view the production block as a potential risk and manage it accordingly. Minimal recommended actions such as destroying the suspect plant as well as all plant material within a 2 meter radius of the suspect plant should be considered.

5.8.2 High Risk Host Plants

The following plants are considered High Risk Host under the Canadian *P. ramorum* Certification Program. All species and cultivars within each genus are considered High Risk⁸:

1. *Rhododendron* including all Azaleas
2. *Camellia*
3. *Viburnum*
4. *Pieris*
5. *Kalmia*

These five (5) plant genera have been connected to virtually all confirmed positive findings of *P. ramorum* in Canada. More rigorous production measures must be followed to minimize the risk of moving *P. ramorum* onto or around the facility by these High Risk hosts.

The mandatory BMP's for High Risk Host Plants are in addition to the highly recommended Nursery BMP's outlined in Section 5.8.1 for all host plants.

⁸ Note that all other host plants are listed by species. See www.cfia.gc.ca/

Mandatory BMP's for High Risk Host Plants

1. a) Container-grown nursery stock

High risk hosts must be segregated from other plants by a buffer of at least two meters (canopy to canopy). The buffer zone may include non-host plants. Note that this practice is risky as non-host plant species could become hosts. If the plants you have selected for your buffer areas become host plants, they must be removed and replaced with non-host plants as soon as possible.

b) Field-grown nursery stock

Findings support that high risk hosts in the field are not as high risk as containerized stock, due to their lack of movement once they are in the ground. If at time of audit, a 2 meter buffer infraction is found around field-grown high risk host plants, this will be determined to be a minor non-conformance rather than a major non-conformance. When the plants are sold or removed, the 2 m buffer must be re-established.

2. High Risk plant hosts with *P. ramorum*-like symptoms must be either:

- Be placed in the isolation area (see note bottom of box), sampled and tested with a Phytophthora field pocket diagnostic kit (Samples can also be sent to a CNCI designated lab for testing)
- or**
- Be culled and appropriately disposed of as outlined in Section 5.8.2 of the Nursery Manual. Note that burning is permitted provided that a burn pile can be regularly used at your nursery location. Culling, burning or disposing (off site) of the systematic High Risk host plant with *P. ramorum*-like symptoms removes the requirement for sampling and testing of these plants.

3. An IPM program must be developed. All risk factors such as the source of plants, irrigation practices and other production process must be considered when developing the IPM program.

Highly Recommended Production Practices for High Risk Hosts:

1. Best efforts should be made to minimize leaf wetness. Irrigation application should result in a period leaf wetness of less than six hours per day.
2. Production blocks of high-risk plants should have a weed control program in place. Weed numbers and growth should be minimized.
3. High risk host plants should be grown in areas with minimal standing water or puddling.
4. Movement of high risk host plants should be minimized.
5. Segregate high risk plants when moving and maintaining in over-wintering houses.
6. High risk host plant 'culls' should be disposed of off-site, preferably in poly bags in a landfill.

5.9 Biosecurity

Biosecurity guidelines have been developed in order to assist each facility in developing measures specific to their own operations that will further help prevent the introduction of *P. ramorum* into the facility. These guidelines are outlined in Appendix VII.

Each nursery participating in the *P. ramorum* Certification Program should develop and document a set of biosecurity measures based on these guidelines. Note that these guidelines are subject to revision as new data and scientific information become available.

Mandatory Biosecurity Requirements

1. A Visitor policy must be in place. The policy must have entry restrictions for production areas based on prior activities of visitors, as well as any other issues that would influence the risk of introducing *P. ramorum* spores into the nursery.
2. A sanitation policy (cleaning and disinfection) must be developed and implemented to minimize the risk of moving spores into and around the nursery. Refer to Appendix IX.
3. All plant debris from external sources, including debris in delivery trucks, must be collected and disposed of by bagging and dumping off-site.

Highly Recommended Biosecurity Practices

1. A record of visitors (visitor's log) to the nursery is recommended. The log should include queries regarding visits to other nurseries, or other activities which could pose a risk of importing *P. ramorum* spores.
2. Movement of staff while working should be from low risk plants at the beginning of the day and progress to high risk plants at the end of the day. Staff should return to the nursery the following day with freshly laundered clothing and clean footwear.
3. Movement of equipment and plants should be managed to minimize spore transmittal around the nursery.

6.0 Audit Requirements

To maintain *P. ramorum* certification the following audit procedures are mandatory.

6.1 Internal Self-Audit

The Administration Manager shall designate a party to perform internal audits. The *P. ramorum*-certified facility must produce a written report on each audit performed. A checklist to assist in the self-audit is included as Nursery Manual Template III.

- An internal audit must be performed twice annually.

Internal self-audits shall take place a minimum of two (2) times per year. The two internal audits must be conducted either: 1) Once during the shipping season and once during the growing season with a minimum of 60 days between audits; or 2) four to six months apart.

If non-conformances are detected during the internal audit, control measures must be taken to ensure compliance with the *P. ramorum* Certification Standard.

6.2 External Audit

For all Program participants:

1. External audits must be performed annually by CNCI designated auditors.
2. The external audit will verify that all actions noted in the facility's approved Nursery Manual are being carried out at the nursery.

- Nursery Certification Manual must be provided to CNCI
- External audit must be performed by CNCI designated auditors annually.
- As CNCP nurseries are audited by CFIA, they are not required to be audited by CNCI auditors.

For new Program participants:

1. An external audit will be completed within twelve (12) months following the approval of the Nursery's *P. ramorum* Nursery Manual. Certification will continue based on external audit verification of compliance with the facility's approved Nursery Manual.
2. If the auditor or CNCI requires that parts of your manual be revised, this must be completed by the date specified, in order to comply with program requirements.
3. Nurseries participating in the Canadian Nursery Certification Program (CNCP) are not required to undergo a *P. ramorum* Certification external audit. However, *P. ramorum* Certification program requirements must be in place and verifiable.

CNCI maintains the right to vary the frequency and detail of the audits. Certified nurseries will be given 30 days notice of such changes.

All written records relating to *P. ramorum* Certified facilities will be maintained at the offices of the CNCI and will be made available to the external auditors.

7.0 *P. ramorum* Detection

When a positive sample is detected through CNCI-authorized sampling and testing, the following events will take place:

1. CFIA must verify the *P. ramorum* positive tests in their own accredited labs in order to confirm the presence of the pathogen. CFIA has final authority to confirm positive results or verify the pathogen was not found.
2. If a suspect positive is found by CNCI testing on a facility but cannot be confirmed by CFIA, it is strongly recommended that the nursery view the block as a potential risk and manage it accordingly. Minimal recommended actions are to destroy the suspect plant and destroy all plant material within a 2 meter radius of the suspect plant.
3. If a *P. ramorum* positive is confirmed, the CFIA will take appropriate action as per the Infested Nursery Action Plan

- i. Facilities must report a CFIA-confirmed positive to the CNCI or its designate within twenty-four (24) hours of confirmation. Failure to report constitutes a major non-conformance.
- ii. In the province of British Columbia, the BCLNA administers the *P. ramorum* Certification Program for the CNCI. A confirmed positive must be reported to the BCLNA. Contact information is:

CNCI Administrator

Phone: 604-574-7772

Toll Free: 1-800-421-7963

info@cleanplants.ca

Fax: 604-574-7773

- iii. A nursery facility with a CFIA confirmed positive will be removed from the *P. ramorum* Certification list and cannot be re-Certified and placed back on the list until the CFIA regulatory actions are concluded. The facility may also have to fulfill actions for CNCI before re-Certification is finalized.

- Nurseries with a confirmed positive must report it to the CNCI or its designate within 24 hours (one working day) of its confirmation by CFIA.
- In the province of BC, nursery growers with a confirmed positive must contact the BCLNA to advise them of their nursery status.

8.0 Non-conformance

A *P. ramorum* Certified nursery unable to maintain the required *P. ramorum* certification conditions or found to have a major non-compliance will be advised in writing of their suspension from the program. Plants must not be moved or shipped as *P. ramorum* Certified from a facility until requirements stipulated in this Standard are met.

Major Non-conformance

The following are considered major non-conformances and will result in suspension from the *P. ramorum* Certification Program:

1. Not reporting a CFIA-confirmed *P. ramorum* positive on the facility to the CNCI or its designate.
2. A positive confirmed by the CFIA on a facility
3. Shipping non-certified plants as '*P. ramorum* Certified'
4. Falsified records
5. Failing to meet the Mandatory Requirements for High Risk Host plants as outlined in the Facility's Nursery Certification Manual⁹
6. Failure to correct non-conformance issues resulting from the external audit within the time frame prescribed by CNCI Administration or CNCI designate.
7. Failing to notify CNCI's designate of changes to the status of high risk hosts at the nursery facility
8. Failure to carry out internal audits twice yearly
9. Refusal to participate in the external audit
10. Refusal to sample and test as required
11. Failure to pay fees for services rendered by the CNCI or its program administrators or designates (on behalf of the CNCI)
12. Two (2) consecutive years of incurring the same minor non-conformance issue(s) may be determined by the external auditor or the CNCI to be a major non-conformance and may result in the facility's decertification from the program.

Facilities which are suspended from the *P. ramorum* Certification Program cannot ship plants as '*P. ramorum*-certified' until corrective measures are taken to bring the facility into compliance with the *P. ramorum* Certification Program. The nursery facility is removed from the *P. ramorum* Certification list published on the CNCI's website (www.cleanplants.ca) and CNLA's website (www.canadanursery.com).

⁹ Using low host plants within the 2m buffer zone is a major non-conformance. When a nursery fails an audit for this reason, it is often necessary to verify that the 2 m buffer is again established. A CNCI representative, not an auditor, will return to the site to verify that the changes have been made. The nursery would pay for the verification at a pre-approved rate. Sampling & testing would continue on the regime noted on the next page for nurseries with a failed audit.

Requirements for Re-certification following a failed audit:

1. Fulfill all remediation requirements as outlined in the external Audit Report.
2. a) Sampling and testing as determined by CNCI (focused sampling of high risk plants):
 - Sampling and testing will be limited to the five high risk host plants: *Rhododendron*, *Viburnum*, *Camellia*, *Pieris*, and *Kalmia* – unless there are symptomatic low risk or non-host plants present,
 - Sampling numbers will be based on the number of the high risk host plants present on a percentage basis. There would be one composite sample taken for every 2,000 high risk host plants, with a minimum of 5 samples and a maximum of 40 samples per facility.
 - A visual inspection will be carried out on all plants;Or:
 - b) A letter from the CFIA verifying that sampling and testing has resulted in negative results. In order for the samples to apply to this program, the CFIA survey results letter must be received by CNCI Administrators *before* sampling and testing is conducted by CNCI.
3. Program compliance must be verified by a CNCI-approved designate (may be an auditor) before the suspension can be lifted.

Minor Non-Conformance

The following are considered minor non-conformances and will result in required corrections and follow-up within a prescribed period of time:

1. Inconsistent record keeping
2. Actions at the facility that are inconsistent with the facility's *P. ramorum* Certification Nursery Manual, except as noted in 'Major non-Conformance;' above. Refer to Template III – 'Audit Checklist' in the Nursery Manual.
3. Not keeping your Nursery Manual up-to-date.

Note: The external auditor or CNCI may determine two consecutive years of incurring the same minor non-conformance issue(s) as a major non-conformance and may result in the facility's decertification from the program.

9.0 Training and Education

In order to qualify for the *P. ramorum* Certification Program, qualified personnel must meet the training requirements as specified below:

The *P. ramorum* Certification Workshop explains the current Certification Standard and is available as a distance training program DVD.

Contact your provincial *P. ramorum* program administrator to order your copy; in BC contact the BCLNA.

***P. ramorum* Administrative Manager:**

1. Must attend a *P. ramorum* Certification Program workshop approved by the CNCI and pass the *P. ramorum* Certification Exam, *or*
2. Participate in CNCI authorized distance training program, and pass an invigilated exam.

***P. ramorum* Implementation Manager:**

1. Must attend a *P. ramorum* Certification Program workshop approved by the CNCI and pass an exam on *P. ramorum* certification, *or*
2. Participate in a CNCI authorized distance training program, and pass an invigilated exam.

Internal Self-auditor

1. Records of all off-site and on-site training must be maintained.
2. It is highly recommended that the internal self auditor watch the *P. ramorum* Certification Workshop DVD and complete the exam. At minimum, the internal auditor must be trained by authorized personnel who have completed the *P. ramorum* Certification Workshop training or a 'Train the Trainer' program and is using the authorized manuals.

- Workshop training for managers is required as noted
- Sampling and inspection staff should participate in a distance training program
- Training must be recorded

10.0 Appendices

Appendix I: <i>P. ramorum</i> Certification Application Form.....	CREAM
Appendix II: <i>P. ramorum</i> Certification Compliance Agreement	YELLOW
Appendix III: Certification Options	TAN
Appendix IV: FACT SHEET - Record Keeping & Traceability.....	GOLD
Appendix V: FACT SHEET - <i>P. ramorum</i> Survey and Sampling Protocols	
.....	MAUVE
Appendix VI: FACT SHEET - Production Practices (BMP's)	PINK
Appendix VII: FACT SHEET - Biosecurity.....	GREY
Appendix VIII: FACT SHEET Preventative IPM program for <i>P. ramorum</i>	GREEN
Appendix IX: FACT SHEET - Disinfection & Sanitation.....	YELLOW

Appendix I: *P. ramorum* Certification Application Form

REGISTRATION FORM

Canadian Nursery Certification Institute

P. ramorum Certification Program

Company

Contact: Owner

Address

Postal Code

Phone

Cell

Fax

Email

Contact (owner or senior employee) who will accompany sampler around nursery: Same as above.

If different, please provide name, cell phone, regular phone number:

Industry Association Membership Information

Please indicate the associations in which you have approved membership:

- BC Landscape & Nursery Association United Flower Growers Co-op Association
 Flowers Canada Forest Nursery Association of BC Western Canadian Turfgrass Assn.
 Have new membership application pending with following association: _____
 Do not belong to any of the above industry association

Check categories relevant for your operation:

Product Information

- Combination of deciduous / conifer / broad-leafed evergreen
 All evergreen (conifer / broad-leafed evergreen)
 All deciduous
 Floriculture – potted only (cuts aren't regulated)
 Mix of SOD host and non-host
 All non-host

Shipping Information

- Export directly to USA
 Expected shipping dates for next 6 weeks:

- Sell to BC company that ships to the USA
 Sell directly to other provinces
 Sell to BC company that sells to other provinces
 All product remains in British Columbia

Production Information

Number of sites: _____ How close to one another? _____

Please provide details on each site sampler will visit:

Sites: give each a name or number	Site Address	# acres	% host plants	% deciduous	% conif/evergreen	% green-house

Appendix II: *P. ramorum* Certification Compliance Agreement



***P. RAMORUM* CERTIFICATION**

COMPLIANCE AGREEMENT

P. RAMORUM AGREEMENT NO. (file number)

THIS AGREEMENT dated this ___ day of ____, 20__

BETWEEN:

Canadian Nursery Certification Institute
Suite 102, 5783 – 176A Street
Surrey, BC V3S 6S6
(the “CNCI”)

AND:

Nursery
Address
Town, Prov. Postal Code

WITNESSES THAT WHEREAS:

- A. The pathogen *Phytophthora ramorum* (Sudden Oak Death or “SOD”) presents an ongoing threat to the nursery industry.
- B. Movement of nursery plants is a known pathway for spreading *P. ramorum* to new locations; and
- C. The CNCI and the Facility wish to enter into this *P. ramorum* Certification Compliance Agreement in order to demonstrate due diligence and to reduce the risk of spreading *P. ramorum* via the movement of plants in the nursery industry.

NOW THEREFORE in consideration of \$10.00 and other good and valuable consideration, the CNCI and the Facility agree as follows:

- I. The Facility agrees to fully implement the mandatory components of the *P. ramorum* Certification Standard which is attached to this Agreement as Appendix 1 (the “Standard”).
 - II. The Facility agrees to follow all instructions contained in this Agreement and the Standard at the following production areas:
(Address of nursery site(s))
 - III. **The Facility acknowledges and agrees that this is a risk reduction program and that fully implementing the Standard is not a guarantee that *Phytophthora ramorum* will not be found at the Facility.**
-
-

- IV. The Facility hereby releases, agrees to indemnify and to save harmless the CNCI from all liability, if any, arising from the movement and sale of plants from the Facility which have been grown according to the Standard.
- V. The Facility agrees to communicate any notification it receives from the Canadian Food Inspection Agency or its designate (the "CFIA") of a positive *Phytophthora ramorum* test to the CNCI or its designate by the next business day following receipt by the Facility of such notification from the CFIA.
- VI. The Facility hereby releases, indemnifies and saves harmless the Canadian Nursery and Landscape Association, the Canadian Nursery Certification Institute, the BC Ministry of Agriculture and Lands, and any associated organizations, their elected and appointed officials, employees and agents, from and against any and all liability, actions, causes of action, claims, damages, expenses, costs, debts, demands or losses suffered or incurred by the Canadian Nursery and Landscape Association, the CNCI, the BC Ministry of Agriculture and Lands, and/or any associated organizations arising from the granting or existence of this Agreement, from the performance by the Facility of this Agreement or any default of the Facility under or in respect of this Agreement.
- VII. The Facility acknowledges and agrees that the Standard is subject to change and agrees to implement any required changes within a reasonable time after written notification thereof has been received by the Facility from the CNCI. The definition of a reasonable time will be determined by the CNCI in its sole discretion.
- VIII. This Agreement is effective on the date of signing, and shall remain in effect until cancelled by either party by written notice delivered to the other at the mailing address appearing above. Notices may be given by mail, in which case they shall be deemed to have been received 5 business days after the date of mailing, or by personal delivery, in which case they shall be deemed to have been received on the date of delivery.

IN WITNESS WHEREOF, the parties have executed this Agreement, intending to be legally bound.

**CANADIAN NURSERY
CERTIFICATION INSTITUTE**

(Nursery Name)

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Date: _____

Date: _____

Appendix III: Certification Options

Certification of Multiple Facilities

- If a nursery has a number of separate facilities, which either have autonomous management structures or are geographically separated, the main nursery may choose to designate each facility as a separate entity in order to minimize the risks associated with *P. ramorum* positive finds.
- Sampling and testing and/or a visual inspection may be required at each facility.
- Each new facility will receive a unique number and will be audited separately.
- Each of these facilities requires a signed Compliance Agreement.
- A Nursery Manual must be prepared for each facility and training of key management staff must be as outlined in Section 1.1
- Separation of one facility into two or more facilities can only occur prior to your nursery's external audit. The intent to separate must be communicated to CNCI Administrations at least one month prior to the nursery's external audit.
- A facility which has outstanding non-conformance issues cannot be separated into smaller entities.
- In order to be considered certified, all fields in the facility (under each certification number) whether in production or fallow, must be listed in the Application and the Nursery Manual.
- Continuation of certification status will be contingent on the designated staff attending prescribed training as described in Section 9 of this document and ongoing compliance of all mandatory sections of this document.

Certification of Contract Growing Sites and New Fields of Production

- If a Certified facility contract grows plant material at another nursery, the contract growing site can be included in the Certified facility's Certification program.
- The growing sites will be considered an extension of the Certified nursery's facility and be listed in their Compliance Agreement.
- The intent to remove growing sites from the Certified nursery's facility must be communicated to CNCI Administration at least 7 days prior to the facility's external audit.

Note: Changing the field locations listed under one Compliance Agreement (for example, manage a separate nursery as a field or to join or to split existing fields) may only take place prior to the start-up of sampling and testing of each year (approximately in May of every year)..

Appendix IV: FACT SHEET - Record Keeping & Traceability

Fact Sheet

Record Keeping & Traceability

Record keeping and traceability of plant movement enables quick determination of where a pest has entered and moved within the facility and when and where it has been shipped out. It is a basic requirement for all nursery certification programs.

- If you are presently keeping one invoice or Delivery memo for accounting purposes, photocopy it and place in an ‘Incoming and Outgoing Shipment Records’ file.
- One ‘Incoming and Outgoing Shipment Records’ file should be consolidated for all nursery certification programs, i.e. CNCP or DPCP and *P. ramorum*.

Recording Incoming and Outgoing Plants:

Nursery facilities have a variety of forms to record sales or purchases. Larger nurseries have comprehensive software systems whereas smaller growers will either have manual invoicing or handwritten documents.

- Your Delivery Memo or Invoice is sufficient as a record for incoming or outgoing plants. The receiver should also provide the visual inspection notation for *P. ramorum* on the document, noting any plant health issues and then initialling the invoice.

- To the right is an example of a ‘check-off’ stamp that growers may wish to develop – growers may include whatever information they feel best meet the Standard’s requirements.

<input type="checkbox"/> <i>P. ramorum</i> Visual Inspection completed
Plant source is <input type="checkbox"/> P.r Certified <input type="checkbox"/> Not Certified
<input type="checkbox"/> No visual symptoms
Leaf disease noted on _____
<input type="checkbox"/> Refuse plants
<input type="checkbox"/> Move to isolation
<input type="checkbox"/> Leaf disease noted as _____
<input type="checkbox"/> Move into production facility

Recording incoming shipments of soilless media and organic ingredients

- A copy of the invoice is sufficient.
- Soilless media and organic ingredients do not need to be certified.

Up-to-Date Map of Facility:

- The map should show buildings, roadways and beds, including isolation blocks and two meter buffers.

- Production beds and field names or numbering system should be on the map. Exact locations of specific plant types is not necessary with the exception of High Risk plant host beds or field rows.
- Include road names approximate dimensions, entry addresses and distinguishing markers, particularly for fields away from the home facility.
- The map does not need to be detailed, but should show the activities in each area, i.e. shipping, propagating house, etc..
- If there is standard plant movement or rotation, this should be noted on the map, i.e. plants move from propagation house to greenhouse to potting shed to production bed, and then shipped.
- High risk host plant beds should also be noted.

Visitor's Log Book:

To maintain records of movement on or off the nursery, the facility may determine that Visitor's Log Book be part of the recorded data. Refer to Appendix VII– 'Fact Sheet Biosecurity' for further details.

Fact Sheet

P. ramorum Sampling Protocols

Internal Sampling and Sampling of Incoming Plants

This section provides guidelines on sampling of incoming plant shipments and on-site sampling of plants with suspicious symptoms. This sampling may be carried out by qualified nursery employees or contractors.

If incoming plants originate from approved *P. ramorum*-certified sources:

- Upon visual inspection, being found 'clean', they may be placed into a *P. ramorum*-certified area of the nursery
- If host plants are found with physical symptoms resembling *P. ramorum*, management decisions and subsequent actions should be outlined in the Nursery Manual, Section 5.6 or 5.8.1. Actions could include refusing the shipment (send the plants back to the supplier), immediate destruction, movement to the isolation area for sampling and testing, etc.
- If non-host plants are found with physical symptoms resembling *P. ramorum*, their treatment should be outlined in the Nursery Certification Manual in Section 5.6.

- *Finding P. ramorum at its early stages of infestation will minimize introduction to the rest of the nursery and out to customers.*
- *Detecting P. ramorum on incoming plants will minimize destruction requirements if a positive is detected in an isolation block.*
- *Sampling and testing of symptomatic plant material to identify pest issues is a major component of all nursery certification programs.*

If incoming plants originate from sources which are not approved by the CNCI (non-certified nurseries in an area known to have *P. ramorum*):

- Host plants (high and low risk) must be placed in isolation blocks as outlined in the Standard, Section 5.2.1. These plants must be sampled, tested and found free of *P. ramorum* before being released into the *P. ramorum*-certified areas of the nursery.
- Non-host plants must be visually inspected, and if found with symptoms, treated as outlined the Nursery Certification Manual, Section 5.2.2. If no symptoms are found, they may be placed into the *P. ramorum*-certified areas of the production facility.

Many growers are now using Pocket Diagnostic kits to screen for *Phytophthora* species. As these kits test for all *Phytophthora* species, not just *P. ramorum*, this test is used as a pre-screen to determine if any *Phytophthora* spores are present. If a *Phytophthora* is detected by the test (and there are over 25 species in BC), then the grower may decide to either destroy all the plants in order to maintain the pest-free status, or may choose to have the plants tested in a CNCI designated laboratory for a definitive diagnosis.

I. Preparing for Sampling

Equipment needs:

- Ziploc bags with paper towel
- Permanent markers
- Disinfectants (e.g. Zep Pine Disinfectant, Lysol, Virkon, Chemprocide or a 10% bleach solution),
- Hand sanitizer (e.g. OneStep, Wet Ones antibacterial wipes)
- Hand-held pruning shears (optional)
- Cooler
- Flagging tape
- Labels
- *P. ramorum* symptoms guide

Sanitation

- Use a hand-sanitizer to clean hands between sample collections and before leaving an isolation block.
- Use a spray bottle containing a disinfectant over all tools.
- Clean all soil or growing media from boots or shoes and spray boots with disinfectant before leaving an isolation block.
- Follow decontamination procedures before and after taking each sample.

II. Sample Collection and Packaging

Sample Selection:

For Incoming Shipments:

- When plant shipments arrive at the nursery determine their origin.
- Obtain a copy of the invoice or packing slip covering the shipment.
- Verify the shipment received against the shipment invoice or packing slip.
- Visually inspect the shipment.
- Follow requirements as noted earlier in this Fact Sheet.

For Plants with Suspicious Symptoms in the Certified Production Nursery:

- Take one sample of suspicious plant material, taking 12-15 leaves for each sample from the same block of plants (species) as noted below. If several species show similar symptoms, take separate samples from each species.

Sample Size

Collect 12 - 15 leaves for each sample.

- If possible, take 1-2 leaves with symptoms from each plant sampled.
- Symptomatic leaves fallen in the immediate vicinity or on the potting soil can also be collected in a sample.
- Collected fallen leaves must still be in good condition.
- Symptomatic shoot tips collected from conifers would be appropriate for sample collection.
- Asymptomatic leaf and/or stem samples may ONLY be collected if NO symptomatic plants of any of the known host genera are present.
- When possible, samples should contain leaves with a range of symptoms.

Block Identification

Use **flagging tape to identify the block** where the plant sample was taken and write the sample # on the flagging tape corresponding to the number assigned on the sample bag.

III. Initial (Pre-screen) Testing for Phytophthora using 'ELISA' Pocket Diagnostic kits.

Kits are available through horticultural supply companies in Canada as well as Europe and the USA. Some kits test for all phytophthoras, some for *P. ramorum* specifically. These test kits are indicators and should not be used solely to provide definitive diagnostics. Follow directions on the kit.

IV. Readyng Samples for Further Laboratory Testing

The BCMAL lab provides many diagnostic services. The *P. ramorum* diagnostic test will test for all phytophthoras first, and then test for *P. ramorum* specifically.

Sample Packaging

1. When collecting tissue samples, put the sample and a dry paper towel in a Ziploc bag.
2. Shake off excess water on the leaves, if present.
3. Label each bag clearly and completely (Sampler's name, file #, full host name (genus, species and variety), block #, date collected and sample #).
4. Flatten the bag (removing air) and close the zip.
5. Place all sample bags into a second larger bag and then into a cooler.
6. Label the package "*P. ramorum* SAMPLES".
7. Deliver the samples to the CNCI designated location.

At the present time, the designated lab is the:

BC Ministry of Agriculture & Lands Diagnostic Laboratory
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3
Phone: 1-888-221-7141

Notification

Ensure that transportation has been arranged such that samples will be delivered to the laboratory as close to 24-48 hours of collection as possible.

Do not send the samples by courier on a Friday.

V. DO'S AND DON'TS OF SAMPLE COLLECTING

Do:

- Wash all debris from sampling tools as noted under sanitation.
- Spray boots with bleach or other disinfectant, brush and rinse them before leaving each nursery facility.
- Attach labels on the outside of bags since labels inside the bag may deteriorate due to moisture and become illegible.
- Include on all labels with a permanent marker: time, date, collector's identification number, location of sample site, full host name and sample number.
- Keep the samples cool: place in foam cooler with ice packs.

Do not:

- Do not add extra moisture to the sample to keep it fresh. The extra moisture will actually speed deterioration of the sample.
- Do not leave samples in sunlight, allow them to dry out, or allow them to get hot.

Acknowledgements: This sampling protocol has been adapted from the United States Department of Agriculture Phytophthora ramorum 2004 National Survey Sampling Protocol, and the Oregon Department of Agriculture: P. ramorum Pathogen-free Certification

FACT SHEET

Nursery Production Practices (BMP's¹⁰)

An important piece of the systems approach that helps minimize the risk of infestation in a facility is the application of effective BMP's during the nursery production cycle. .

P. ramorum is a pathogen that can be found in both soil and water, and can infect via roots, leaves and young stems of susceptible plants.

- Spores are easily detached from an infected plant when leaves are wet. Transfer to the soil, clothing and equipment is effortless when working with these infected plants. Leaf wetness can be due to natural weather conditions like rain or fog or other cultural practices such as overhead irrigation or misting.
- Spores in the soil move easily in water with their fin-like flagella.
- Cut or injured plant surfaces are very susceptible to *P. ramorum* spores, and even more so when the injured areas are wet.

P. ramorum is Mobile in Wet Conditions

Minimizing the potential movement of the pathogen in water is a critical factor for growers to consider when planning their production practices:

- It is highly recommended that all host plants be grown in areas with minimal standing water or puddling to decrease the degree to which the pathogen could move from plant to plant. One nursery was confirmed with a low incidence of *P. ramorum* one year; the following winter flooding took place, and over the next season, many new positives were detected. Scientists suspect that the flooding enabled the spores to move around the nursery to be taken up into the roots of susceptible plants., This spread of infection was despite eradication efforts made at the nursery.
- To minimize spore movement by persons or equipment, growers should review their production schedules and practices to reduce spread of *P. ramorum* when spore movement is most active. This could mean avoiding working in beds with host plants during rainy periods or right after irrigation, or only working in host plant beds at the end of the day with subsequent sanitation of clothing and tools before the beginning of work the following day. Whatever policy is adopted should be included in the Nursery Certification Manual.
- Growers must also develop an Integrated Pest Management program based on their risk of contracting *P. ramorum*:
 - Facilities which run only closed production (propagated from their own stock) and have no incoming plants or outside visitors have a low risk of contracting the disease.

¹⁰ Best Management Practices

-
- Facilities that purchase a large amount of stock, including host plants, from a variety of suppliers have a much larger risk of importing the disease unknowingly.
 - Facilities that purchase a large proportion of High Risk host plants from a variety of sources, particularly rhododendrons, have a very high risk of contracting *P. ramorum*.

A pest management program, in cases where there is higher risk, may include preventative applications of fungicides to minimize sporulation and infection under optimum conditions (warm and wet). In this case, the grower may determine that their IPM program include alternating fungicide sprays of Aliette and Subdue MAXX at times when overhead irrigation is required or prior to an anticipated long period of rainfall.

***P. ramorum* will survive in soil and plant debris.**

Although *P. ramorum* sporulates on leaves of plants, spores will drop and survive in the soil and on debris that falls to the ground.

- *P. ramorum* has been found in cull piles and in debris at the base of plants in BC.
- Plants with *P. ramorum* will often shed their infected leaves which, if not gathered and disposed of off site, will provide a suitable environment for a long-lived source of infection.
- Debris should be collected and disposed of off-site whenever possible. This may occur during winterization, when moving containers from bed to bed, when potting up, etc.
- When leaves are wet, spores are easily dislodged, thus collection of debris should take place during dry times.
- Growers should consider their degree of risk and determine what debris removal policy should be included in the Nursery Manual to minimize the risk of creating a suitable environment for sporulation and spore survival.

High Risk Host Plants

The five high risk hosts, *Rhododendron*, *Camellia*, *Viburnum*, *Pieris*, and *Kalmia*, are responsible for over 90% of the outbreaks of *P. ramorum* and are usually in close proximity to other plants that have also become infected.

The BMP's as noted for General Nursery Production also apply to High Risk Host Plants.

Since both camellias and rhododendrons often show few symptoms, extra precautions are required when producing these plants. Viburnum is often symptomatic and will show symptoms very quickly. Note that infection during optimum conditions (warm and wet) only takes 12 hours; symptoms may show in as little as 72 hours - or not at all.

- High risk host plants must be segregated from low risk host plants to minimize the chance of infection by water movement or spores becoming dislodged by wind under wet conditions.
- A two meter buffer (canopy to canopy) is a minimum standard for these plants. If plants are tall (over 1 meter), growers may wish to provide an even wider buffer.
 - Free moisture is even more significant with high risk hosts than with other plants, thus making the requirement for minimizing standing water or puddling mandatory. Growers should move High Risk plants to high, well drained areas on the nursery, contain them in raised beds, or provide other means to ensure that water drains away quickly from the base of the containers.
 - Reducing leaf wetness to less than 6 hours is highly recommended when using overhead irrigation.
- In BC, leaf spots and dieback are the most common symptoms of *P. ramorum*. The quickest way to assess if the plant has *P. ramorum* or another similar disease is to have the 'spots or dieback' diagnosed. There are two options for diagnosis:
 - The Diagnostic Lab at the BC Ministry of Agriculture and Lands provide ELISA testing as well as nested PCR to determine if the sample is positive for *P. ramorum*, as do several labs across Canada and Europe. The BCMAL lab is required to report all positives for *P. ramorum* to CFIA.
 - You may purchase a 'hand-held' ELISA testing kit to test on-site.

Diagnostic Procedures and Outcomes:

- The ELISA tests will diagnose to the level of genus of pathogen.
 - If an ELISA comes back positive, it means that there is a *Phytophthora* (species unspecified) present in the plant.
 - It does not mean that *P. ramorum* is detected specifically.
 - At this point of detection, you may choose to destroy the plants that have tested positive for *Phytophthora* spp. as part of a regular 'clean stock;' program. Destroying plants within two meters of the infected plant as well as any others that are symptomatic is recommended.

- If you wish to determine what type of *Phytophthora* is present, another testing step must be performed. If *P. ramorum* is confirmed, CFIA will be called (as required by law) to confirm the test results. If CFIA's tests confirm the positive, then the Infested Nursery Action Plan is enforced at your nursery.

FACT SHEET

Biosecurity

Biosecurity measures increase the likelihood that *P. ramorum* spores will be controlled or removed from your premises before they have a chance to produce infections and spread.

All *P. ramorum* infections have come from sources outside of BC nurseries. However, once a nursery has been infected, it is very difficult to eradicate the disease without extreme measures.

Prevention of *P. ramorum* entering nursery production areas is a critical factor to a nursery's continuing growth and prosperity – both in the short and long term.

The level of biosecurity measures implemented must be related to the degree of risk of the facility, the location and number of plant suppliers and the amount of 'traffic' – people, tools, equipment movement into and around the nursery.

Development of a Biosecurity Policy' at your Nursery Certification Manual should be based on a review of the risk factors, your style of operation, your source of plants, and frequency of incoming traffic. The biosecurity policy outlined in the Nursery Manual must be implemented as part of the requirements of the *P. ramorum* Certification program.

The main objective of biosecurity measures is to decrease the risk of allowing the movement of *P. ramorum* spores into your nursery and subsequent spread through your nursery via people or equipment.

- *P. ramorum* spores are easily dislodged from wet leaves onto clothing and the ground
- *P. ramorum* spores can linger in dropped leaves and plant debris and be picked up on footwear and tools
- *P. ramorum* spores can be killed on surfaces using proper disinfection and sanitation techniques
- Determine what measures YOU can take in your nursery and on incoming people, equipment and tools to destroy viable spores.

In your Nursery Manual, you will write how you will manage:

- the separation of potentially infected plants in your isolation area and plants in the main production area
- Visitor movement within your nursery, including customers
- Workers – both coming on-site and working on your facility – including in the high-risk host and segregated areas
- The flow of plants through the nursery and into the shipping area
- plants that have left the 'clean' production areas from re-entering (all plants must be visually inspected first, symptomatic plants and host plants must be placed in isolation for testing)

Following are some of the areas to consider and define in your Nursery Manual:

Visitor Policy:

- How are you going to determine if a person has the potential to move spores into your nursery?
- A visitor policy must include what questions you should ask your guests and how you will perform this task. A common policy that has been employed is a Visitor's log or 'Guest Book. Visitors are asked several questions as shown below. This log book can also provide you with any other information about your potential client that you wish.

Name	Company	Have you visited another nursery or farm in the last 24 hours?	If so, where?	Would you like to be on our mailing list?

Your visitor policy should also outline under what circumstance procedures are required to ensure the visitor does not bring in *P. ramorum*. Each procedure implemented must effectively stop *P. ramorum* from entering the nursery. For example, all visitors with prior visits to other nurseries must use 'clean boots' provided, or wear disposable booties, or step in an antiseptic bath, or only be allowed to ride on the gator when in the nursery.

- The choice is up to you, as you are trying to prevent *P. ramorum* coming on to your nursery.
Be pro-active – it's your business at stake!

Isolation Areas and Segregated 'High Risk Host Plants'

These are both critical areas where equipment and foot traffic should be managed carefully to minimize spore transfer. You must decide on the policy for movement of staff, vehicles and tools when moving to and from isolation areas, the High Risk plant segregation blocks or your 'hot' area in your shipping zone.

Examples:

- To limit the chance of spore transfer you may require that a set of equipment and clothing be used for a specific area, The equipment and clothing are not to be used in any other part of the nursery.
- You may require that truck, gator and trailer beds be sanitized after moving plants to and from isolation areas or High Risk plant production beds, or after driving onto truck beds
- You may require workers to use disinfectant 'stations' providing spray bottles and cloths to wipe blades, and hand sanitizers to kills spores on hands prior to moving from one production area to another or from an isolation area to a production area.

- You may require that no work be done while plant leaves are wet, if this is possible. Alternatively, you may decide that workers should work in the high-risk beds only at the end of the day, and clothing to be washed before returning the following day.

Vehicle Sanitation:

- As there is evidence that spores can live in soil for several years, growers should consider the risk of bringing spores into the nursery on vehicle under carriages and tires.
- Growers may choose to spray tires, or require trucks to remain in a ‘hot’ zone in the shipping area to minimize the chance of moving *P. ramorum* spores into the nursery
- Any debris from vehicles should be bagged and disposed off-site. Debris cannot be swept onto the parking lot or into adjacent areas.
- Your policy decisions must be included in your Nursery Manual.

Contract Workers

Contract workers move from facility to facility and are a risk to your operation. Each worker should go through a sanitation procedure before moving onto your nursery.

- Clothing and footwear should be clean. You may wish to require their boots be sprayed with a disinfectant.
- Tools, equipment and machinery should be hosed down and sanitized before entering the production area.
- Vehicle tires should also be sanitized if the ‘outside’ vehicles transport workers into the nursery production area.

Sanitation for Staff:

Based on your degree of risk, you may set your sanitation policy at any one of many levels to minimize the chances of *P. ramorum* spores moving around the nursery:

- You may choose to require clean clothing at the start of each workday, including washed boots and clean gloves.
- You may decide, in the instance of low risk, that boots be sanitized before entering the facility and hands washed with antiseptic soap prior to at the beginning of the work day.
- You may wish to provide clothing, i.e. overalls, T-shirts, sweatshirts for your staff to wear on-site.

All biosecurity procedures must be included in your Nursery Manual

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Appendix VIII: FACT SHEET Preventative IPM program for *P. ramorum*
FACT SHEET
**Integrated Pest Management (IPM) Program for
*P. ramorum***

Integrated pest management (IPM) is a decision-making process that uses all available techniques to manage pests. The program attempts to optimize growing conditions for the crop while making the conditions less favourable for pest development. The key components of a nursery IPM program are discussed in the Standard, for instance:

- Biology and spread of *P. ramorum* in Appendix VII,
- Steps to take to reduce the risk of introducing *P. ramorum* to a site in Appendix VII (Biosecurity),
- Disinfectants registered for use in the biosecurity program in Appendix IX,
- Routine monitoring for *P. ramorum* is covered in Sections 5.4 and 5.6, and
- Production practices that will reduce the risk of *P. ramorum* establishment and spread at a site (e.g. managing leaf debris and leaf wetness) in Section 5.8.

The component of an IPM program that is covered in this Appendix is preventive fungicide applications. The decision to spray a crop should be based on the level of risk that it may become infected with *P. ramorum*.

Assessing the Level of Risk that a Crop may have *P. ramorum*

Growers should determine whether or not a particular crop needs to be sprayed on the level of risk that it may become infected with *P. ramorum*. There are many factors that influence risk, including the type of crop, where it was sourced, and aspects of the production system. These points are summarized in Table 1. Crops that are rated as “Higher Risk” in one or more of the categories may be included in the spray program, depending on the level of risk the nursery is willing to accept.

Nurseries that have a history of purchasing a large proportion of high risk host plants from a variety of sources, or have previously had a *P. ramorum* detection, are the most at risk. Correspondingly, their IPM programs likely would be the most rigorous. The Canadian Food Inspection Agency has developing a set of mandatory best management practices that a positive nursery must implement before they can be released from quarantine. The practices are outlined in the [Eradication Protocol for Propagation Nurseries Confirmed with *Phytophthora ramorum*](#). This step is necessary to reduce the risk of a repeat detection of *P. ramorum* at a nursery.

Table 1. Some points that influence the level of risk that a crop may become infected with *P. ramorum*. This information should be used when evaluating whether a crop needs to be sprayed and the frequency of fungicide application. Please note that the level of risk is not equivalent for all of the items within the “Higher Risk” column.

Source of Risk	Lower Risk	Higher Risk
Crop (genus)	<ul style="list-style-type: none"> not a high risk host 	<ul style="list-style-type: none"> a high risk host (e.g. <i>Camellia</i>, <i>Rhododendron</i>, <i>Kalmia</i>, <i>Pieris</i>, and <i>Viburnum</i>)
Source of Plant	<ul style="list-style-type: none"> stock propagated in-house tissue culture plants received in culture stock from a state/province other than British Columbia, California, Oregon and Washington³ 	<ul style="list-style-type: none"> stock purchased from a nursery in California, Oregon, and Washington, or in the European Union, Norway, and Switzerland¹ stock from a non-certified nursery in British Columbia²
Production System	<ul style="list-style-type: none"> field-grown⁴ greenhouse stock 	<ul style="list-style-type: none"> container stock grown outdoors stock held in overwintering houses
Irrigation System	<ul style="list-style-type: none"> drip, trickle, sub-irrigation system 	<ul style="list-style-type: none"> overhead irrigation

¹ Plants received at a nursery from other locations pose the greatest risk of introducing *P. ramorum* into the nursery. However, monitoring at delivery is not necessarily adequate to detect infected plants, as infected plants may be symptom-free. The nursery should decide whether to take additional precautions with incoming stock even if it is not formally required to go into isolation. Oregon growers are encouraged to isolate 100 plants or 10% of each lot (whichever is greater) of host plants received. These plants are not to be treated with any fungicide that is effective against *Phytophthora* species for 3 to 6 months. During this period, the plants are observed for *P. ramorum* symptoms. This holding period provides an opportunity for disease suppressive fungicides to wear off and/or the occurrence of favourable weather conditions that will result in disease development and, thus, aid in the timely detection and eradication of *P. ramorum*.

² The Canadian *P. ramorum* Nursery Certification Standard requires host plants purchased from a non-certified nursery in British Columbia to be placed in isolation upon receipt.

³ *P. ramorum* has been detected at facilities in the Midwest and eastern seaboard of the US. To evaluate the risk level of a supplier's stock, it is prudent to ask for details on their *P. ramorum* program and about detections in their area.

⁴ Field-grown production has been classified as "lower risk" because there have been relatively few detections of *P. ramorum* on it relative to container stock. This is perhaps due to wider plant spacing and less frequent overhead irrigation. Field stock that is grown at a high density (e.g. seed beds) may be considered as "higher risk".

When Should a Fungicide Spray be Applied?

Once it has been determined which crops require fungicide sprays, the grower needs to decide under what conditions the stock will be sprayed.

- Apply fungicides prior to infection - ***There are no fungicides that can eradicate P. ramorum from a plant.***
 - The available fungicides prevent new infections by preventing *Phytophthora* spores from germinating and/or suppressing further growth of the pathogen within an already infected plant. They do not kill *P. ramorum*.

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- For this reason, it is critical to apply fungicides as preventive treatments, **prior** to infection.
 - Once *P. ramorum* has infected the host, fungicides will only temporarily stop its growth.
 - Once the chemical activity subsides, *P. ramorum* will resume growth.
 - Apply prior to extended rainy periods in the spring and fall - *P. ramorum* is a water mould and its disease cycle is dependent on water.
 - Spores produced by *P. ramorum* on infected leaves and shoot tips are responsible for disease spread.
 - Cool and damp conditions (6 to 12 hours of leaf wetness) are required for spore germination and infection to occur.
 - Based on laboratory trials, the optimum temperature for infection is between 16 and 25°C, but infection can occur from 2 to 28°C.
 - Nursery outbreaks of *P. ramorum* in North America and Europe have been associated with extended rainy periods.
 - The fall period appears to be particularly important for disease development and spread.
 - The environment in an overwintering polyhouse may be conducive to infection and spread throughout the winter.
 - Apply when there is new vegetative growth.
 - Young foliage is often more susceptible to *P. ramorum*.
 - Research on *Pseudotsuga menziesii* has found that shoots are susceptible to infection immediately after bud break (Chastagner et al., 2004). The shoots were less susceptible 2 to 8 weeks later.
 - Apply fungicides following activities that create wounds on the stock.
 - Research has demonstrated that wounds are favourable entry points for *P. ramorum* spores.
 - Apply a preventive spray following pruning or other cultural activities that create wounds on the plants.

What Fungicides Should I Use and How Often Should they be Applied?

- Acrobat[®], Aliette[®], and Subdue MAXX[®] are registered to manage *P. ramorum* in Canada.
 - Daconil[®] is registered to control Phytophthora dieback on *Rhododendron* and *Pieris*.
 - Fungicides act primarily to protect plants from new infections and should be applied preventively when conditions are favourable for *P. ramorum* infection.
 - Rotate fungicides
 - Repeated application of a single fungicide, particularly Subdue MAXX[®], or of fungicides in the same chemical group can lead to the development of pest resistance. A strain of *P. ramorum* that is less sensitive to Subdue MAXX[®] has already been detected in Belgium.
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- To delay the development of fungicide resistance, it is important to rotate the use of fungicides that belong to different resistance management groups. Acrobat[®] (Group 5), Aliette[®] (Group U), Daconil[®] (Group M), and Subdue MAXX[®] (Group 4) are all in different fungicide groups and can be used as rotational products. In general, Group M fungicides, i.e. Daconil, are considered broad-spectrum and less likely to result in resistant development.
- Subdue MAXX[®] should be the first preventive spray applied, followed by sprays of Acrobat[®], Aliette[®] and/or Daconil[®] on a 1 to 3 week schedule while conditions favour development of *P. ramorum*. Refer to the label for the exact application interval for each product.
 - Subdue MAXX[®] has provided a high level of protection in most research trials and is registered for a broad range of ornamental crops. Research has shown that Subdue MAXX[®] is effective for 2 to 3 weeks. For *P. ramorum*, foliar sprays of Subdue MAXX[®] are more effective.
 - Acrobat[®], Aliette[®], and Daconil[®] are somewhat less effective than Subdue MAXX[®].
 - Acrobat[®] and Aliette[®] have broad registrations while Daconil[®] is only registered to control Phytophthora dieback on *Rhododendron* and *Pieris*.
 - Consider applying the rotational fungicides beginning 2 to 3 weeks after the application of Subdue MAXX[®].
 - Note that only 3 applications of Subdue MAXX[®] and 4 applications of Aliette[®] are permitted per crop per year, and 4 applications per crop per season for Acrobat[®].
- Thorough spray coverage increases fungicide efficacy.
 - Spores infect primarily through the lower surface of the leaf although the pathogen can also enter through wounds.
 - Good fungicide coverage, in particular of the lower leaf surface, improves the efficacy of the treatment. This is especially important for Daconil[®] which is a contact fungicide (non-systemic).
- Records of all fungicide applications must be maintained at the nursery as per federal or provincial regulatory agency requirements (Section 4.5 of the *Phytophthora ramorum National Certification Standards*).

Additional Information on the Registered Fungicides

Acrobat[®] 50WP (dimethomorph, Group 5)

- Acrobat[®] 50WP is registered to suppress *P. ramorum* on ornamentals deemed to be hosts of this pathogen by the Canadian Food Inspection Agency.
- It can be applied to outdoor, container and field grown ornamental plants (including conifers) in nurseries and landscape plantings.
- Apply 48 g/100 L, or 450 g product in at least 200 L of water per ha, as a foliar spray applied to run-off.
- Apply a maximum of 4 applications per crop per season at 10 to 14 day intervals. Apply no more than 2 consecutive sprays before alternating with a fungicide with a different mode of action.

Chipco Aliette[®] Ornamental Fungicide (fosetyl-al, Group U)

- Chipco Aliette[®] Ornamental Fungicide is registered to suppress *P. ramorum* on ornamentals deemed to be hosts of this pathogen by the Canadian Food Inspection Agency.
- It can be applied to greenhouse container and field-grown ornamental plants in nurseries and landscape plantings, and conifers grown in nurseries and landscape plantings.
- Apply as a foliar spray at 5 kg of product per hectare. Apply in a water volume not greater than 1,000 L/ha. Spray to wet. Do not apply to run-off.
- Reapply if necessary 2-3 weeks later. Treat when there is sufficient leaf area present to take up the spray; when leaves are actively growing, and at least 30 days prior to leaf drop in deciduous species.
- Do not apply more than 4 applications per year.

Subdue MAXX[®] Fungicide (metalaxyl-m, Group 4)

- Subdue MAXX[®] Fungicide is registered to suppress *P. ramorum* on ornamentals deemed to be hosts of this pathogen by the Canadian Food Inspection Agency.
- It can be applied to greenhouse container and field grown ornamental plants (including conifers) in nurseries and landscapes.
- For field grown ornamental plants, mix 7.8 – 15.6 mL of product in 100 L of water and spray to run-off.
- For indoor and outdoor container grown ornamentals, two use patterns are approved.
 - Drench at seeding: mix 24 mL with 1,000 L of water and apply 5 L of solution per m².
 - Drench at transplanting: mix 40 mL with 1,000 L of water and apply 5 L of solution per m².
- Do not make more than 3 applications per year. Repeat if necessary at 2 to 3 month intervals.

Daconil[®] Ultrex (chlorothalonil, Group M)

- Is registered to control Phytophthora dieback of *Rhododendron* and *Pieris*, and for other diseases on a range of ornamentals.
 - Apply at the rate of 1.5 kg per 1,000 L of water.
 - Apply sufficient spray to obtain adequate coverage, but do not exceed 2,000 L of water per hectare.
 - Repeat on a 7 to 14 day schedule until conditions are no longer favourable for disease development.
 - Do not apply more than 3 applications per year.
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FACT SHEET

Disinfection & Sanitation in Nurseries

The following information is meant to provide growers with options for bio-security and sanitation measures, dependent on the degree of risk in their facility.

P. ramorum can be spread by the movement of infected plants and of contaminated soil, water, and plant debris. Spores can travel on vehicles, equipment / tools, and workers. In order to reduce the risk of introducing and spreading *P. ramorum*, a nursery needs to adopt an integrated approach that may include exclusion (restrict access), supplier selection, cultural practices, and sanitation.

Sanitation is an important component of a nursery's *P. ramorum* biosecurity program. Nursery sanitation guidelines include:

- Collecting fallen leaves for disposal
- Propagating from clean stock plants
- Testing of surface or recycled irrigation water for *Phytophthora* spp.; treat if present
- Using new pots If you must re-use pots, clean them first.
- Off-loading shipments in an area that can be cleaned. Leafy debris must be cleaned up, bagged, and disposed of;
- Preventing pathogen spread on workers, vehicles, equipment, tools, and on production beds between crops;
- Ensuring compost used in media has undergone a sufficient period of high temperature (>55°C for 14 days) to eliminate pathogens;
- Not storing potting media on bare soil; and
- Preventing the spread of pathogens from the cull pile to production areas.

The removal of debris from surfaces (container beds, benches, wagons, etc.) will greatly reduce the risk of *P. ramorum* spread. However, at times it may be desirable to more rigorously sanitize a surface. This can be achieved with the application of a disinfectant. Disinfectants are oxidizing agents that kill microorganisms. Some common disinfectants used at nurseries include alcohols (e.g. ethanol, isopropanol), halogens (e.g. chlorine bleach), peroxides (e.g. Hyperox[®], Virkon[®]), and quaternary ammonium (e.g. Chemprocide[®], Virocid[®]). All of these disinfectants are fast-acting, broad spectrum and low toxicity biocides.

There are a number of factors to consider when selecting a disinfectant. Some of these factors are presented in Table 1. Other factors to consider are safety to workers and the environment. Disinfectants can irritate eyes, skin and/or mucous membranes. Use safety equipment recommended on the label when mixing, loading and applying disinfectants. Never mix bleach with ammonia or acidic solutions because these combinations will produce toxic chlorine gas.

Table 1. Factors to consider when selecting a disinfectant.

Disinfectant	Factors that Reduce Disinfectant Efficacy	Corrosive	Residual Activity
Alcohol	<ul style="list-style-type: none"> organic matter (alcohol does not readily penetrate organic matter) too high a concentration of alcohol (>90%) 	no	low
Bleach	<ul style="list-style-type: none"> bleach is unstable and efficacy is reduced by organic matter, sunlight, water pH, and temperatures below 20°C 	yes (to metals)	low
Peroxide	<ul style="list-style-type: none"> organic matter sunlight 	moderate (to metals)	limited
Quaternary Ammonium	<ul style="list-style-type: none"> soap hard water (>400 ppm Ca⁺²) 	no	good (9-day ½-life in soil)

Prior to disinfecting a surface, it is critical that it is free of soil and organic matter. Always clean and rinse soiled surfaces prior to applying disinfectants. Textured surfaces will require additional cleaning. It is also important to remove inorganic salt deposits because they can shield spores from the disinfectant. An acid-based cleaner will be necessary to remove salt deposits.

Disinfectants for Staff and Visitors:

Locate hand wash stations and foot baths at entrances to the facility, and to greenhouses and isolation blocks.

Hand wash stations - antimicrobial hand soaps (e.g. OneStep[®], Purell[®] Hand Sanitizer) are a reasonable substitute for hand washing as long as they are not visibly soiled. These products usually contain alcohol in a quick-drying gel formulation.

Foot bath or boot spray – a plastic tub lined with foam can be used as a foot bath. Put a lid on the tub to reduce evaporation and to prevent pets from consuming the disinfectant solution. There are also foot bath mats that can be purchased from a number of local agriculture suppliers. The foot bath will not be too effective on soiled footwear. Footwear should be exposed to the foot bath solution for at least 30 seconds.

- Virkon[®] (1% or 10 g/L) – change weekly; use test strips to measure disinfectant activity
- Chemprocide[®] (1.5% or 15 g/L) – change biweekly; use test strips to measure disinfectant activity
- Hyperox[®] (0.8% or 8 g/L) – change solution daily or when soiled

Quick Dip Disinfectant Treatments for Tools/Cutting Knives: there are pruners on the market that automatically apply a disinfectant solution to the blades when a cut is made.

- 70% alcohol
- 10% household bleach (prepare by mixing 100 mL of bleach in 900 mL of water). Caution: bleach solutions are corrosive to metals.

- 0.1 or 0.2 % Chemprocide[®] (mix 1 or 2 mL of Chemprocide[®] per litre of water). Use the lower rate for plants that are sensitive to Chemprocide[®]. Due to its long residual period, toxic levels of Chemprocide[®] can accumulate on cutting tools. Periodically rinse the blades to remove the disinfectant residue
- 5% Virkon[®] (dissolve 50 g in one litre of water)

Disinfection of Production Areas:

- Chemprocide[®] is the only disinfectant registered for use in greenhouses. Thoroughly wet the surface and do not rinse off. Use 8 mL of Chemprocide[®] per litre of water for greenhouse surfaces and equipment. Use 30 mL of Chemprocide[®] per litre of water for wood, painted and concrete surfaces.

Disinfection of Vehicles:

- Clean the truck in a commercial vehicle steam-cleaning facility before returning to the nursery. Steam cleaning will significantly reduce the risk of *P. ramorum* propagules being present on the vehicle.
- Chemprocide[®] - Pace Chemicals recommends applying Chemprocide[®] at the rate of 4 mL per litre of water to disinfect the box of shipping vehicles. If there are plants in the box, the rate is to be reduced to 1 mL per litre of water.
- Virkon[®] - wash and rinse all surfaces of the vehicle prior to disinfection. Disinfect all vehicle surfaces inside and outside using a 1% dilution rate (= 1 mL Virkon[®] + 99 mL of water). The inside of the cab can be wiped down with a cloth soaked in Virkon[®]. (**From:** “Vehicle Biosecurity Procedure Checklist” produced by the manufacturer of Virkon[®], Vetoquinol).