

Pathogen-Tested Certification Program for Caneberry Nursery Stock Production Systems

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State Level Model Regulatory Standard

**Pathogen-Tested Certification Program for
Caneberry Nursery Stock Production Systems**
(hereafter referred to as **Caneberry Certification Program**)

DRAFT – January 2016

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by a working group
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This is a draft document.

Please e-mail Rose Gergerich gergeric@uark.edu with your comments and feedback

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The following section headings may be included in the regulation, if required by state certifying agency's legal counsel, who may supply standard language:

Review

Legislative Authority

Approval/Endorsement

Implementation

Distribution

Amendment Record

An accurate public record of amendments to this certification program should be maintained. Consult the certifying agency's legal staff on the possibility of posting the amendments on a persistent website that can be referenced within the body of the regulation.

Background

Since *Rubus* species are propagated vegetatively for all commercial purposes, systemic pathogens can spread rapidly to progeny during the production of nursery stock. Plantings that are infected with viruses cannot be cured. However, plants free of target viruses can be obtained from infected plants by a combination of thermal or cold treatment and shoot tip culture, and sometimes with the aid of inhibitors of virus multiplication. The only way to eliminate a virus from a planting or block of nursery plants is to destroy the infected plants and replant with tested, clean plants in a sanitized site.

Clean stock programs rely on several principal components: starting with plants that have been thoroughly tested and found free of targeted pathogens; defined production practices that minimize the risk of infection; and quality control to monitor plant health status. Plant production begins with plant material that is free of pests of concern (economically important and/or quarantine pests). This first generation (G1) is increased through one or more cycles (G2, G3, G4) to produce sufficient material for commercial production of the crop. G1 plants have the highest level of pest freedom, and each successive generation has its own standards for production and cleanliness. The certifying agency of the state where production of successive generations is carried out is responsible for ensuring that the plants meet the standards for cleanliness at that level.

This model regulatory standard is a systems-based approach for the certification of pathogen-tested caneberry nursery stock, hereafter referred to in this document as the caneberry certification program. The program includes identification of risks (pathogens and their vectors), the critical control points for management of these risks, and the best management practices such as isolation distances, vector control, pathogen testing, and field inspection to minimize the risk of introduction and spread of the designated pathogens of caneberry. The quality control component ensures that the plant material produced in each generation of the clean stock program meets the rigorously defined standards for that generation. Procedures to determine that plants are free from pathogens include visual inspection, testing with bio-indicators, and laboratory tests such as serology (e.g., ELISA) and/or molecular tests (e.g., polymerase chain reaction).

Participation in this program is voluntary. Any nursery stock produced in this program must also meet all other mandatory phytosanitary requirements, and must be maintained in a healthy state. A state or agency can certify caneberry plants for export to a country that has import requirements within the testing and production standards contained in this standard.

Scope

This standard describes the essential elements of nursery stock pathogen-tested certification for caneberries (blackberry, raspberry and hybrids), hereafter referred to as the caneberry certification program. Pests specifically dealt with in this standard are viruses (excluding those that are not graft transmissible [cryptic viruses, etc.]), viroids, phytoplasmas, fastidious bacteria and their vectors. The regulatory standard does not address other pests, abiotic disorders, or quality grades and standards. Trueness-to-cultivar is not part of this program; it is the responsibility of the nursery. Caneberry plants

or parts of these plants may be designated as G1, G2, G3 or G4, if they and the stock from which they were produced have been propagated, inspected, indexed, and tested in accordance with procedures and requirements outlined herein and found to be in compliance with all standards and requirements established here.

References

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Common Definitions, Abbreviations and Acronyms

Accession - The word ‘accession’ is used in certain plant collections, such as those of the USDA-ARS’ repository collections and in clean plant centers, to indicate a single plant source of one genotype contained with the collection. This term is used alternatively to selection.

Animal and Plant Health Inspection Service – The Animal and Plant Health Inspection Service (APHIS) is an agency within the United States Department of Agriculture. APHIS provides leadership to ensure the health and care of animals and plants and has jurisdiction over quarantine programs and plant introductions in the United States. <http://www.aphis.usda.gov/>

APHIS – See Animal and Plant Health Inspection Service (USDA)

Applicant – An individual or nursery that formally applies to propagate and sell caneberry plants under the conditions outlined for this standard

Asexually propagated – Plants are reproduced using the following methods: cuttings, layering, division, grafting, budding and tissue culture. Asexual propagation does not involve exchange of genetic material. Plants are identical to their parent unless there is a genetic mutation.

Audit – A systematic and independent examination to determine whether an auditee’s activities conform to a set of pre-specified standards of a program

Balled and burlapped – Plant stock which is removed from the growing site with a ball of soil containing its root system intact and encased in burlap or other material to hold the soil in place

Bare-root – Plant stock which has been removed from the growing site with the root system free of soil

Block – A contiguous grouping of plants separated from other contiguous groupings of plants by a buffer zone

Buffer zone – An area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of target pests or diseases into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate

Candidate G1 plant – A plant which is in the process of being tested for designated pathogens and, if necessary, which is being treated to eliminate pathogens

Caneberry – Raspberries, blackberries and hybrids (including boysenberries, loganberries and other hybrid types) belonging to the genus *Rubus*

Certification program – A comprehensive process established, authorized and performed by a state or other governmental entity to minimize the re-introduction of regulated pests and diseases in planting stock once it has left G1/foundation facilities. The regulations for each program define the program participation, plant production, plant identification and labeling, and quality assurance requirements.

Certified – Having met the requirements and been approved for certification under this program

Certifying agency – The official plant regulatory agency, or any entity approved by the official plant regulatory agency, that performs pathogen certification work

Compliance agreement – Any written agreement between a person and a regulatory agency to achieve compliance with any set of requirements being enforced by the agency

Containerized plant - Any live plant grown in a container where the plant is healthy, vigorous, well-rooted, and established in the container in which it is growing

Container stock – Nursery stock which is transplanted in soil or in a potting mixture contained within a rigid container for a period sufficient to allow newly developed fibrous roots to form so that if the plant is removed from the container its root-media ball will remain intact

Cover crop – A crop planted to prevent soil erosion and suppress weed growth

Critical control point - A key step in a system where specific procedures can be applied to achieve a defined effect and can be measured, monitored, controlled and corrected

Cultivar – A variety or sub-variety of a plant species that was developed under cultivation and is propagated for a specific trait(s)

Director, commissioner, secretary of agriculture – The person who has the regulatory authority in the official plant regulatory agency or a duly appointed representative

Dormant plant - Any plant or plant part that is not actively growing as evidenced by the lack of vegetative bud swelling and/or shoot growth

ELISA (Enzyme-Linked Immunosorbent Assay) – A serological test in which antibodies are used to detect plant pathogens

Field – A plot of land with defined boundaries within a place of production on which a commodity is grown

G level – Signifies the degree to which plant stock is related to the original pathogen-tested plant material. Regulations developed by certification programs specify the conditions under which each G level must be maintained in order to qualify for the program.

G1 – Plant material is tested for all targeted systemic pathogens and maintained as described in this standard. These plants are used as sources for producing subsequent generations of plants.

G2 - Plant material is propagated from G1 stock and grown under specific conditions to prevent infection. G2 stock is frequently maintained by nurseries in increase blocks to supply to commercial growers.

G3 - Plant material is propagated from G2 stock. G3 stock is commonly used in secondary increase blocks and certified nursery blocks.

G4 - Plant material is propagated from G2 or G3 stock. G4 stock is destined for delivery to the producer.

Growing medium – Any material in which plant roots are growing or intended for that purpose

Harmonization – The establishment, recognition and application by different countries or states of phytosanitary measures based on common standards

Heat therapy or heat treatment – Protocols used to aid in the production of plants free of systemic pathogens. This technique is often followed by meristem tip culture of the treated material for efficient elimination of viruses.

Import permit – An official document authorizing importation of a commodity in accordance with specified phytosanitary requirements

Increase block – A nursery planting made with G1, G2 or G3 stock which has been registered to serve as a source for the production of plants for a certification program

Indexing – A procedure to determine whether a plant is infected by graft transmissible agents. It involves the transfer of a bud, scion, sap etc. from one plant to one or more kinds of indicator plants.

Indicator plant – Any plant used to index for virus/pathogen infection

Inspection – Official examination of plants, plant products or other regulated articles to determine whether pests are present and/or to determine compliance with phytosanitary regulations

Lot – A number of units of a single commodity, identifiable by its homogeneity of composition, origin, etc. Lot size is flexible and defined by the nursery. Large lot sizes will require fewer numbers of samples tested, but if a sample tests positive in a large lot, then retesting/delimiting the problem may need to occur.

Meristem tip culture – Tissue culture in which the meristem tip of a plant is extracted from the shoot and placed in tissue culture. A true meristem tip has no leaf primordia.

Micropropagation – Vegetatively propagating plant material *in vitro* on a defined medium

Microshoot tip (tissue) culture – Meristematic tissue placed in sterile tissue culture growth media where the new plant develops. A microshoot tip normally includes several leaf primordia.

NAPPO – See North American Plant Protection Organization

National Clean Plant Network (NCPN) - A national network aiming to protect U.S. specialty crop agriculture and the environment from the spread of diseases and pests that cause economic damage. The enabling legislation requires that NCPN: (1) produce clean propagative material; and (2) maintain blocks of pathogen-tested plant material throughout the United States.

<http://nationalcleanplantnetwork.org/>

National Clean Plant Network for Berries (NCPN – B) – A commodity committee of the National Clean Plant Network, created to protect U.S. specialty crop agriculture and the environment from the spread of targeted plant diseases and pests of berry crops that cause economic damage. The enabling legislation requires that the NCPN: (1) produce clean propagative material; and (2) maintain blocks of pathogen-tested material throughout the United States.

National Berry Crop Certification Board – Individuals from nurseries, researchers, and regulatory personnel with responsibility to regularly review and update the requirements and recommendations of the National Standards for Nursery Certification for Caneberry, Blueberry and Strawberry

NCPN – See National Clean Plant Network

NCPN-B – See National Clean Plant Network - Berries

Nepovirus - A genus of polyhedral plant viruses in the family *Secoviridae*. Transmission occurs by seed, pollen, nematodes, or by mechanical means.

North American Plant Protection Organization – A regional Plant Protection Organization of the International Plant Protection Convention. NAPPO coordinates the efforts among Canada, the United States and Mexico to protect their plant resources from the entry, establishment and spread of regulated plant pests and diseases, while facilitating intra/ interregional trade.

Nursery – In certification program standards, a building, greenhouse, plant production area, or similar entity established for the purpose of propagating plants

Nursery-matured – Tissue culture plants planted in a nursery setting to grow to a salable size

Official – Established, authorized, or performed by a regulatory agency such as the USDA or a state certification agency

Off-type – Appearing to be different from the species or variety listed on the application or exhibiting symptoms of a genetic or non-transmissible disorder

Participant – An individual or enterprise that participates in this program and meets all requirements of this standard

Pathogen – An organism causing disease. Examples of pathogens include viruses, bacteria, phytoplasmas, fungi, etc.

Pathogen-tested – Tested and found to be free of pathogens as defined by a regulatory standard

PCR – See Polymerase Chain Reaction

Pest – Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products

Pest management plan – A written description of procedures and processes designed to control, suppress or eradicate pest populations to a level that meets the standards of this program

Plants – Living plants and parts thereof including seeds and germplasm

Polymerase Chain Reaction (PCR) – A detection technique that amplifies a segment of the genome of a target organism (for example a virus)

Proprietary – Distribution of plant material is restricted to or controlled by a specific entity

Quarantine – The official confinement of regulated articles for observation and research or for further inspection, testing, and/or treatment

Quarantine pest – A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled

Registered – A plant that has been enrolled and meets all requirements of the program

Regulated non-quarantine pest – A pest whose presence affects the intended use of plants and which is therefore regulated within the territory of the contracting party

Regulated pest – A quarantine pest or a regulated non-quarantine pest

Restriction – A phytosanitary regulation allowing the importation or movement of specified commodities subject to specific requirements

Suspended – The registration status is temporarily withdrawn from material previously included in the registration and certification program

Systems approach – The integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests

Test or testing – Official examination, other than visual, to determine the presence of pests. This may include biological indexing, serological or molecular tests, or any other method approved by the certifying agency.

Tissue culture – General term for the cultivation of plants (cells, tissues, organs) under aseptic conditions *in vitro*. The term also refers to the cultures themselves.

United States Department of Agriculture (USDA) – Government agency overseeing all major aspects of agriculture in the United States

USDA – United States Department of Agriculture

Variety – A subdivision of a species. The term *cultivar* is preferred for horticultural varieties which are produced by selective breeding and maintained in cultivation.

Virus – A submicroscopic obligate parasite consisting of nucleic acid and protein unable to produce energy but able to evolve

Virus-like – A graft-transmissible disorder with symptoms resembling a virus disease, including, but not limited to, diseases caused by viroids, phytoplasmas, and fastidious bacteria

Virus-tested – Tested and found free of viruses designated in this standard

Outline of Requirements

The objectives of this standard are to:

- Prevent the introduction or spread of systemic pathogens in caneberry production systems
- Facilitate trade of pathogen-tested caneberry nursery stock

This standard outlines the essential elements of a voluntary certification program for managing systemic pathogens and their vectors, achieved through a combination of best management practices and mandatory requirements. It outlines a systems-based approach for minimizing the risk of pathogen introductions associated with the production of caneberry nursery stock. This standard references appendices designed to be maintained by the certifying agency; they contain details and requirements specific to the individual certifying agency's pathogen-tested certification program. The certifying agency will make the appendices available on a website and through contact with the agency.

The certifying agency is not responsible for disease, genetic disorders, trueness-to-cultivar, failure of performance, or mislabeling in connection with this certification program. No grower, nursery dealer, government official, or other person is authorized to give any expressed or implied warranty, or to accept financial responsibility on behalf of the certification agency.

1. General Requirements

1.1 Regulated Commodities

All propagative plant parts of *Rubus* species including raspberries, blackberries, and hybrid caneberries (boysenberries, loganberries and other hybrid types) belonging to the genus *Rubus*. Plant material eligible for registration must originate from a source approved by the certifying agency who will also determine the certification level of the material.

1.1.1 Plant Material from an Approved Pathogen-Tested Certification Program

Caneberry plant material may be moved into certification if produced under an official caneberry certification program that has been evaluated using this standard and approved by the certifying agency. The caneberry stock must originate from a recognized domestic or foreign pathogen certification program that is also approved by USDA for import into the United States. The certifying agency must perform a nursery inspection as outlined in this standard, including testing samples for the presence of pests listed in the caneberry certification program (Appendix 1). A certifying agency may disapprove a source that it determines could pose a pest risk to the certification system.

If no documentation of the origin or pathogen status of the plant material is available, the certifying agency must prohibit entry of the material into the certification program. This material may be submitted to a G1 facility for cleanup, testing and entry into the certification program.

1.2 Program Participation

The nursery must be actively enrolled in state nursery registration/certification. The nursery must also apply with the certifying agency for participation in this program.

1.3 Caneberry Pests

An exhaustive list of the systemic pathogens of caneberry covered in this program is given in Appendix 1.

The certifying agency has the responsibility to address the pathogen list in Appendix 1, but must adapt the list to reflect high risk pests of current concern in their state or region that are appropriately addressed through this certification program. Any changes to the list will be based on criteria to include:

- Credible, documented information on pathogen presence or absence in the state or surrounding areas
- Patterns of nursery stock movement
- Testing availability

1.4 Domestic Movement

Any plant material certified under this program being shipped domestically must include documentation that the shipping nursery maintains active state nursery certification or registration, and that the shipment complies with any applicable laws, regulations, and quarantines of the originating and destination locations. The shipment may also include documentation related to certification under this program, such as a statement declaring:

“State of Production Name Certified Caneberry Nursery Stock. The accompanying nursery stock is certified to have been produced in compliance with requirements of the National Caneberry Certification Program.”

1.5 Application and Fees

An initial application for participation in the certification program shall be made on a form prescribed by the certifying agency. An application form template is available in Appendix 2. Upon receipt of the initial application, the certifying agency will begin a dialog with the nursery that will result in a cooperative agreement, a pest management plan or compliance agreement, and an initial program entrance review of the nursery. By applying, the facility is granting the certifying agency access to all production areas, records, and plant material for nursery evaluation, inspection and testing purposes.

The certifying agency will establish and post fees for program participation and/or certification-related activities.

Except as otherwise provided, fees charged by the certifying agency for participation in the program are for the sole purpose of defraying expenses incurred by the certifying agency for implementation and documentation procedures provided for in this program, and for providing funds to the certifying agency to support appropriate plant pathogen surveys and related research. Payment thereof shall not be construed as granting any right or privilege to the applicant.

2. Specific Requirements

This standard deals specifically with essential elements of a certification program to mitigate the risk of viruses and other systemic pathogens listed in Appendix 1.

This program is carried out by or under the authority of the state certifying agency. The agency will be charged with the administration of requirements such as terminology, testing, eligibility, nomenclature of certification levels, horticultural management, isolation and sanitation requirements, inspection and re-testing, documentation of test and inspection results, identification and labeling of certified plants, quality assurance, noncompliance and corrective measures.

2.1 Program Administration

Responsibility for administration of the program resides with the certifying agency. While the certifying agency has oversight for all aspects of certification, it may establish a system of approval or accreditation for certification work to be performed by others. The certifying agency employs or accredits administrative, inspection and laboratory diagnostic personnel that have the appropriate training, experience, education and proficiency requirements necessary to implement the program. The agency will maintain records of this information, and allow for transparency of these records to all appropriate parties as allowable by state or federal law. Personnel training and staff responsibilities can be found in Appendix 3 and testing protocols and procedures can be found in Appendix 10.

Nurseries must submit application and renewal forms to the certifying agency. The nursery must maintain all other documents referenced in this regulation in paper or electronic format. Documents must be formatted to meet all required standards of the certifying agency, and the documents must be available for review by the certifying agency upon request. Nurseries should be aware that other information that is submitted voluntarily to the certifying agency may be subject to Freedom of Information requests.

2.2 Eligibility and Approvals

Eligibility of potential participants is conferred by the certifying agency upon fulfillment of the application process (see section 1.5), if the conditions of this certification program have been met.

All plant material to be enrolled in this program, and each site for planting of registered blocks, must be approved by the certifying agency.

2.3 Certification Levels

Certification levels represent a categorical measure of the pathogen tested status of caneberry plants certified under this program. This certification program supports production of stock at certification levels appropriate for international and national commerce (G-levels).

2.3.1 G-level

The G-level signifies the degree to which plant stock is related to the original fully tested plant material entering a production system. G-levels represent successive generations of propagation from the original tested material as described in this standard, and additional phytosanitary measures may be applied depending on the G-level. This certification program specifies the conditions under which each G-level must be maintained in order to qualify for certification at that level, including testing specifications, regular inspections, isolation requirements and other conditions under which the plants must be grown to prevent infection.

2.3.1a G1

G1 refers to the original plant(s) that has been tested and found to be free of the systemic pathogens covered by this standard, and subsequently maintained in isolation to prevent infection. G1 also refers to plants produced from the original sources of pathogen-tested plant material and maintained under equivalent conditions.

Production and maintenance of G1 material must be within a system approved by USDA-APHIS or its designee. All G1 material, whether of domestic or foreign origin, must meet the same testing criteria and requirements.

2.3.1b G2

G2 plant material is propagated from G1 stock or, in the case of expanding a G2 block, from a G2 plant in the same block, and is maintained under specific conditions to prevent infection. Propagation and maintenance of G2 plantings (including testing) is described in Appendix 5. G2 stock is frequently maintained by nurseries as source material for subsequent generations of pathogen-tested certified nursery stock. Any vegetatively propagated material used for the production of a G2 plant must originate from G1 plants. G2 plants can be made available to nurseries and other plant improvement facilities for further propagation under restrictions that are specific to this level or may be sold to fruit growers and exit the certification scheme. G2 plants used for further propagation are propagated under conditions appropriate for the G2 level.

2.3.1c G3

G3 plant material must be propagated from G1 or G2 stock, or in the case of expanding a G3 block from a G3 plant in the same block, and grown in accordance with the propagation and maintenance requirements for G3 stock given in Appendix 6. G3 stock is frequently maintained by nurseries to increase the amount of available source material for the production of pathogen-tested certified nursery stock. G3 plants can be used to increase the size of an existing G3 block or may be sold directly to fruit growers and exit the certification scheme. G3 plants used for further propagation are propagated under conditions appropriate for the G3 level.

2.3.1d G4

G4 stock is commonly grown in certified nursery blocks, and G4 is the material distributed for sale for fruit production (i.e. wholesale and retail nursery stock). Any vegetatively propagated material used for G4 production shall have originated from a registered G1, G2, or G3 source. Propagation and maintenance (including testing) requirements for G4 plants are described in Appendix 7. G2 plants in tissue culture that are “nursery matured” and G3 plants that are grown for sale are considered G4 plants for testing purposes, and can only be sold as G4 plants.

2.4 Horticultural Management of Caneberry Plants at All Certification Levels (see Appendices 4-7 for G-level specific requirements)

All plants in the certification program should be kept in good horticultural condition by following recommended horticultural practices for their region.

Water treatment is not required for municipal water supplies or for irrigation water where there is no opportunity for contamination by native soil or plant material/debris. If water sources are derived any other type of open body of water including rainwater collection systems or if water is recycled or recirculated, treatment of water is required or a water management program designed to minimize overwatering and standing water in production areas must be adopted.

2.4.1 Screened Greenhouse/Screenhouse Plantings

Screened greenhouses/screenhouses must be located, constructed and maintained to minimize the introduction of pathogens transmitted by aerial and soil-borne vectors from the surrounding area. The growing media and containers must introduce no pest risks of concern for this program. Overlap between cultivars must be avoided.

Screened greenhouses/screenhouses that are not initially approved may be re-evaluated if the nursery undertakes corrective measures as approved by the certifying agency.

2.4.2 Field Plantings

Planting sites must be selected to minimize the introduction of pathogens transmitted by pollen, and aerial and soil-borne vectors from the surrounding land, and through drainage, flooding, irrigation or other means.

Because of the risk of infection from soil-borne viruses, it is strongly recommended that G3 and G4 plants are grown in containers. If plants are grown in the field (planted in the ground), planting sites must be selected to minimize the introduction of pathogens transmitted by aerial and soil-borne vectors from the surrounding land through drainage, flooding, irrigation or other means.

G3 and G4 nursery blocks must only be planted on land which has been free from non-certified *Rubus* species, *Rubus* species at a lower certification level, solanaceous crops and other known hosts for soil-borne viruses that affect *Rubus* species (dandelions, peaches, grapes, cherries, etc.) for a period of at least ten years, or for G4 plantings, the entire site must be treated for soil-borne virus vectors. The entire site must be at least 500 feet from any noncertified caneberry plants unless the plants don't flower during propagation in which case an isolation distance of 100 ft from noncertified caneberry plants is required. Caneberry nursery production in areas where blackberry yellow vein virus occurs is restricted to screened greenhouse or screenhouse propagation.

Chosen planting sites must be tested for nematodes and will not be approved for production if tests are positive for nematode transmitted viruses, or for nematodes capable of transmitting those viruses. Sites that are not initially approved may be re-evaluated if the nursery undertakes corrective measures as approved by the certifying agency.

Expansion or addition of new material to an existing registered block is possible upon request to the certifying agency. All requirements that must be met for a new block will also be required for expansion of a registered block.

2.4.3 Containerized Plants

Containerized plants at any certification level may be accepted into this certification program if they meet all general requirements for registered plants at the specified certification level, in addition to meeting the following requirements:

- a) The growing medium and containers must introduce no pest risks of concern for this certification program. The certifying agency may approve methods of risk mitigation. Risk mitigation measures for containerized plants are given in Appendix 8.
- b) The containers must be at a site appropriate to the certification level. In the event that containerized plants are moved, the plants will only maintain their certification level if the new site has been approved by the certifying agency.
- c) The containerized stock must be labeled in a manner that allows for proper identification and tracking.

2.4.4 Tissue Culture

Nurseries may use tissue culture techniques to multiply plants prior to planting if the following conditions are met: (1) the tissue culture facility is approved by the certifying agency and the nursery follows their approved pest management plan or compliance agreement, (2) the tissue culture plants are isolated at all times from other caneberry plants, except those that have been indexed and found to be free of the pathogens specified in this standard, and (3) for G2 tissue culture plants, a representative plant(s) is taken out of tissue culture and established in a greenhouse for at least three months before inspection and testing as described for registered caneberry plants at the G2 level.

2.5 Isolation, Pest Management and Sanitation

2.5.1 Isolation Requirements

The isolation requirements of the certification program will vary according to the certification level and should be based on the biology of the pests and their vectors present in the certification area. Buffer zones are necessary to reduce the chance of infection by pollen-borne and vectored pathogens. The isolation requirements for each G-level can be found in Appendices 4-7.

2.5.2 Sanitation and Pest Management

The participating nurseries will produce and implement a pest management plan or enter into a compliance agreement that addresses the measures they apply to prevent systemic pathogen introduction into their certified plantings. A pest management plan is a detailed, written description of procedures or processes designed to eradicate, control, or suppress pest populations to a level that meets this standard (as dictated by regional differences). The pest management plan will address the following critical control points:

- a) source material procurement
- b) site selection processes
- c) production processes

Just as the risk of certain pathogens varies due to geographical differences affecting vectors and conditions of transmission, so too will each facility's pest management plan or compliance vary due to regional differences.

Templates for a pest management plan and a compliance agreement are available in Appendix 9. A nursery's pest management plan must be reviewed and approved by the certifying agency; major revisions to a pest management plan or compliance agreement must also be submitted for approval.

General pest management practices, while not directly related to this certification program, may impact the status of the certified material. While the pest management plan or compliance agreement produced under this program specifically deals with the three critical control points listed above, the certifying agency has the authority to require any additional practice or documentation it deems necessary for the verification of certification status. All material should, besides the diseases mentioned here, meet any other pest quarantine requirements as dictated by the certifying agency for the region or state within which the plants are grown.

2.6 Inspection and Testing

Plants entered in the program will be inspected during the growing season at times appropriate for the detection of disease symptoms and presence of pest vectors according to accepted survey patterns.

Inspection and testing is also required for candidate sites. The inspectors will follow the protocols established in the inspection and testing guidelines maintained in Appendix 10. These guidelines address the following considerations:

- a) frequency and timing of inspection and testing necessary to address perceived risks
- b) sampling and testing procedures
- c) process to be undertaken upon suspicion or confirmation of pest presence

2.7 Documentation, Identification and Tagging

The primary purpose of the records required in this section is to document the pathogen-tested status and maintain the identity of the material being produced and sold under this program. These records include documentation of plant production and pest management practices to verify that the nursery has implemented the regulations as described for this program. All material used in the production of G4-level certified nursery stock must be traceable to approved G1 through G3 sources.

Records must be kept in an organized manner on the nursery premises and must be made available to inspectors on request. The facility must maintain records on its premises for a period of time (established by the certifying agency) from the date of propagation for G1, G2, G3 and G4 plants.

2.7.1 Certifying Agency Responsibilities

The certifying agency will document inspection, certification and testing activities undertaken in compliance with this standard to ensure the eligibility and status of the plant material, production sites, participants and all certification levels of the plants. These documents will be available, upon request, to the USDA or other certifying agencies for audit, trace-back and trace-forward, and other regulatory purposes.

2.7.2 Nursery Responsibilities

The nursery must document and identify plants during growth, post-harvest, and at sale to ensure traceability. The nursery must maintain records on its premises for a period of time established by the certifying agency, and must update critical records within a time frame agreed upon with the certifying agency. The nursery must make these records available to the agency upon request. Record-keeping requirements for each G-level can be found in Appendices 4-9.

2.7.3 Identifying Marks

The certifying agency and the nursery manager must agree upon appropriate labels, tags or signs to properly identify all certification levels of pathogen-tested material at the nursery. The labels must be weather-resistant and must distinguish material grown under this program from other types of material. The nursery manager must notify the certifying agency in advance if the nursery wishes to modify the labeling system. Failure to properly label and identify certified plant material will result in the removal of that material from certification, and may jeopardize the certification status of adjacent material.

2.7.3a. Source Materials

A system to correctly identify and maintain traceability of any tissue culture explant, or other material to be used in the production of pathogen-tested certified canebrerry plants must be agreed upon by the facility and the certifying agency.

2.7.3b. Plants Used for Propagation

In G1 and G2 blocks, each plant must bear permanent identification using a system agreed upon by the nursery and the certifying agency.

In G3 and G4 blocks, or in nursery propagation of G2 or G3 plants for sale, all stock must be clearly marked. Labeling may be by any clearly identifiable unit such as plant, partial row, row, or block. Although this standard does not address trueness-to-cultivar, an inspector may disqualify a variety from certification if off-types or other indicators of problems with traceability are detected.

2.7.3c. Containerized plants

Identifying marks of any containerized plant must be directly attached to the plant.

2.7.3d. Harvested Stock

Harvests of individual plants, bundles or crates must be labeled to maintain their identity and clearly separate them from material not in the program.

2.8 Nursery Evaluation

Nursery evaluations continually monitor and verify the status of the production nursery's plant material, records, and administrative procedures to ensure conformity with this program. Nursery evaluations determine whether the facility has the resources, infrastructure, and staff in place to successfully implement the procedures outlined for acceptance into the certification program.

The certifying agency will conduct an initial program entrance review upon application. After a nursery has entered into a cooperative agreement, the certifying agency will conduct at least one nursery evaluation per year in addition to the inspections that fulfill the requirements of section 2.6 *Inspection and Testing*. Any nursery evaluation may include inspection and/or testing of records, plants or sites, especially in reference to ongoing, new, or perceived risks. The certifying agency may adjust the frequency of inspections as necessary.

2.8.1 Initial Program Entrance Review and Subsequent Nursery Evaluations

Nursery evaluations are systematic examinations of the organizational structure, procedures, processes, and resources used within the participating facility to implement the nursery certification program. The objective of a nursery evaluation is to align the facility's production system, including its pest management plan or compliance agreement, with the standards of the certification program. The annual nursery evaluations will take place at a time agreed to by the certifying agency and the approved nursery.

The initial program entrance review and annual nursery evaluations will assess all elements of this program using the checklists in Appendix ___ or certifying agency equivalents.

2.8.2 Surveillance Evaluations

Surveillance evaluations supplement the annual nursery evaluation by targeting one aspect of the implementation of the certification program at the nursery. All program requirements defined in section 2.6 *Inspection and Testing* will be addressed in surveillance evaluations; additional surveillance evaluations may be performed if deemed necessary by the certifying agency. Surveillance evaluations shall be directed by the certifying agency.

2.9 Non-compliance and Corrective Measures

2.9.1 Non-Compliance

System elements which are not in compliance may be detected by the certifying agency or the nursery. If detected by the certifying agency, the nursery will be informed in writing of the corrective actions required for compliance. The facility must make corrections promptly, within a timeline at the discretion of the certifying agency. If detected by the nursery, the certifying agency may require notification and/or documentation of any actions the nursery took to correct the non-compliance. Failure to follow the protocol may result in denial of certification status.

The number and type of non-compliance issues found determine the status of the facility and the subsequent nursery evaluation frequency. Appendix ___ provides guidelines for classification of non-compliance; however, the certifying agency may modify classification in a situation, based on an evaluation of the associated risk and whether the integrity of the certification program has been compromised.

A template for a corrective action request form can be found in Appendix ___. Each corrective action request includes a detailed description of the measures that the nursery will implement to prevent recurrences of the non-conformance and a timeframe for completing the corrective actions. Failure to follow the prescribed actions may result in suspension of the nursery from the certification program.

2.9.2 Suspension or Cancellation of Registration

Non-compliance with program requirements may result in cancellation or suspension of the registration status of the nursery, block, or registered caneberry plants managed by the nursery. The certifying agency will specify the consequences of non-compliance, which may vary depending on the nature and severity of the infraction. The corrective measures to enable a suspended or de-certified participant, production area, or variety to become eligible for reinstatement or re-certification will be determined on a case-by-case basis by the certifying agency.

Registration of the nursery may be canceled if certification claims are misused or misrepresented. Program participation may be suspended if program fees are not paid. Following suspension or cancellation of registration, a nursery must re-apply to be evaluated for reinstatement into the certification program.

3. Evaluation of External Sources and Cooperation with Other Certifying Agencies

The certifying agency may periodically audit/review approved programs to ensure they continue to meet all certification standards and requirements. Detection of targeted systemic pathogens or vectors controlled under this certification program or deficiencies of documentation, etc. may indicate that the integrity of the certification system is compromised.

This is a draft document: Please e-mail Rose Gergerich gergeric@uark.edu your comments and feedback

State Level Model Regulatory Standard

Pathogen-Tested Certification Program for Caneberry Nursery Stock Production Systems

Appendix 1. Pathogen List

All graft-transmissible pests must be considered at the level of importation of plant material into the U.S. or entrance of domestic or foreign material into G1 certification. The list of all known agents for inclusion at that level of virus certification is outside the scope of this document, but is maintained by the Center for Environmental and Regulatory Information Systems (CERIS) in the Export Certification Project (EXCERPT) database (<http://ceris.purdue.edu/ceris/>).

For state-level certification programs, the assumption is that G1 material is free of all graft-transmissible agents, alone or in mixed infections with other pathogens, so certification activity should focus on detection of systemic pathogens that are known to occur in the state and that can spread naturally in the field. Secondly, certification programs may monitor for systemic pathogens that occur in the state but are not known to spread naturally, as a means to identify infected source materials entering the certification stream. Finally, the certification agency may incorporate any inspection or testing component required by trading partners. Since inspection and testing of source materials for virus certification is an efficient means of surveillance for exotic invading pests, education on exotic pest detection and occasional survey for such pests is encouraged, although not required and always subject to availability of funds.

A matrix of pests that should be considered in a pathogen-tested caneberry certification program for blackberries and raspberries, along with the rationale for inclusion in this program, is provided below. Each state may adjust the list and level of surveillance based on the distribution of the pathogen in their state or region, the availability of reasonable inspection or testing protocols, and the trading needs of the program. All material should, besides the diseases and pathogens listed here, also be checked for the presence of other pathogens which can be transmitted on propagation material.

A. Pathogen List. List of pathogens covered in this standard, regional occurrence and acceptable diagnostic tests^a

| Organism | Bioassay ^b indicator host/self indicator | Laboratory assays | PCR ^c | Regional occurrence and risk in the US ^f | | | | | | |
|---|---|--------------------|---------------------------|---|----------|---------------|----|----|----|------------------|
| | | | | Pacific NW | Upper MW | South Central | NE | SE | CA | |
| Viruses | | | | | | | | | | |
| Raspberry | | | | | | | | | | |
| Apple mosaic virus (ApMV) | | ELISA ^d | RT-PCR^e | 5 | 5 | 5 | 5 | 5 | 5 | |
| Arabis mosaic virus (ArMV) | | ELISA | RT-PCR | 4 | 5 | 5 | 5 | 5 | 5 | |
| Black raspberry necrosis virus (BRNV) | Graft indexing to <i>R. occidentalis</i> and <i>R. henryi</i> | | RT-PCR | 1 | 1 | 1 | 1 | 1 | 5 | |
| Cherry leaf roll virus (CLRV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Cherry rasp leaf virus (CRLV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Raspberry bushy dwarf virus (RBDV) | Graft indexing? <i>Chenopodium. quinoa</i> | ELISA | RT-PCR | 1 | 1 | 1 | 1 | 1 | 1 | |
| Raspberry leaf blotch virus (RLBV) | | | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Raspberry leaf mottle virus (RLMV), (aka Raspberry leaf spot virus [RLSV], and Raspberry mottle virus [RMoV]) | Graft indexing to <i>R. occidentalis</i> or <i>R. idaeus</i> | | RT-PCR | 1 | 5 | 5 | 5 | 5 | 5 | |
| Raspberry leaf curl agent (RLCV) | Graft indexing <i>R. idaeus</i> or <i>R. occidentalis</i> | | | 5 | 1 | 5 | 1 | 5 | 5 | E. of Rocky Mts. |
| Raspberry latent virus (RpLV) | | | RT-PCR | 1 | 5 | 5 | 5 | 5 | 5 | |

| | | | | | | | | | | |
|---|--|-------|---------------|---|---|---|---|---|---|--|
| Raspberry ringspot virus (RpRSV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Raspberry vein chlorosis virus (RVCV) | | | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Rubus yellow net virus (RYNV) | Graft indexing on <i>R. idaeus</i> , <i>R. macraei</i> or <i>R. occidentalis</i> | | RT-PCR | 1 | 1 | 5 | 1 | 5 | 5 | |
| Sowbane mosaic virus (SoMV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Strawberry latent ringspot virus (SLRSV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Strawberry necrotic shock virus (SNSV) aka as Black raspberry latent virus (BRLV) | <i>C. quinoa</i> | ELISA | RT-PCR | 1 | 5 | 1 | 5 | 1 | 5 | |
| Tomato black ring virus (TBRV) | | ELISA | RT-PCR | 5 | 5 | 5 | 5 | 5 | 5 | |
| Tomato ringspot virus (ToRSV) | <i>C. quinoa</i> , <i>Cucumis sativus</i> | ELISA | RT-PCR | 1 | 1 | 5 | 1 | 1 | 5 | |
| Blackberry | | | | | | | | | | |
| Blackberry chlorotic ringspot virus (BCRV) | <i>C. quinoa</i> | | RT-PCR | 1 | 5 | 1 | 5 | 1 | 1 | |
| Blackberry calico agent (BCV) | <i>C. quinoa</i> , <i>R. idaeus</i> , Marionberry | | | 1 | 4 | 4 | 4 | 4 | 4 | |
| Beet pseudo-yellows virus (BPYV) | | | RT-PCR | 4 | 5 | 1 | 5 | 1 | 5 | |
| Blackberry leaf mottle virus (BlMaV) | | | RT-PCR | 5 | 5 | 3 | 5 | 5 | 5 | |
| Blackberry vein banding associated virus (BVBaV) | | | RT-PCR | 5 | 5 | 3 | 5 | 5 | 5 | |
| Blackberry virus E (BIVE) | | | RT-PCR | 4 | 5 | 1 | 5 | 1 | 5 | |
| Blackberry virus F (BIVF) | | | RT-PCR | | | 2 | | 2 | | |
| Blackberry virus S (BIVS) | | | RT-PCR | 5 | 5 | 1 | 5 | 1 | 5 | |

| | | | | | | | | | | |
|---|-------------------------------------|-------|---------------|---|---|---|---|---|---|--|
| Blackberry virus Y (BVY) | | | RT-PCR | | | 1 | | 1 | | |
| Blackberry yellow vein associated virus (BYVaV) | | | RT-PCR | 1 | 1 | 1 | 1 | 1 | 1 | |
| Grapevine Syrah virus 1 (GSyV-1) | | | RT-PCR | 5 | 5 | 5 | 5 | 3 | 5 | |
| Impatiens necrotic spot virus (INSV) | | ELISA | RT-PCR | 4 | 5 | 1 | 5 | 1 | 5 | |
| Raspberry bushy dwarf virus (RBDV) | Graft indexing? <i>C. quinoa</i> | ELISA | RT-PCR | 1 | 1 | 1 | 1 | 1 | 1 | |
| Tobacco ringspot virus (TRSV) | <i>C. quinoa</i> | ELISA | RT-PCR | 5 | 1 | 1 | 1 | 1 | 5 | |
| | | | | | | | | | | |
| Phytoplasma | | | | | | | | | | |
| Rubus stunt | Graft indexing to <i>R. idaeus</i> | | PCR | 4 | 4 | 4 | 4 | 4 | 4 | |
| Black raspberry witches' broom phytoplasma | | | PCR | 1 | 5 | 5 | 5 | 5 | 5 | |
| Bacteria | | | | | | | | | | |
| Crown gall | Symptoms on nursery stock | | | 1 | 1 | 1 | 1 | 1 | 5 | |
| <i>Xylella fastidiosa</i> | | | PCR | 4 | 5 | 5 | 5 | 5 | 1 | |

^a See Appendix 12 for testing guidelines

^b Bioassay using sap transmission from caneberry to indicator plants, or graft transmission to various *Rubus* indicator plants

^c Polymerase Chain Reaction

^d Enzyme-linked Immunosorbent Assay

^e Reverse Transcriptase Polymerase Chain Reaction

^f 1 – occurs and moves in the environment, 2 – present at low levels, 3 – reported to occur, 4 – not known to occur, 5 – no data available, these ratings refer to the presence of the pathogen in caneberry, not in other crops. For those viruses with 5s all the way across the table, the virus has not been found in caneberry in the United States.

B. For symptoms, reported distribution, and diagnostic tests for caneberry pests of concern in nursery stock production see the following references:

Martin, R.R., MacFarlane, S., Sabanadzovic, S., Quito, D. Poudel, B., and Tzanetakis, I.E. 2013. Viruses and virus diseases of *Rubus*. *Plant Disease* 97:168-182.

Compendium of Raspberry and Blackberry Diseases and Insects. 3rd edition to be published by APS Press, 2016.

DRAFT

Appendix 2: Program Application Forms

Initial Application for Participation

Instructions:

This application must be completed and signed by a designated representative of the applying nursery. The signature indicates that the nursery understands and is willing and able to comply with the requirements of this program including, but not limited to:

- Granting the certifying agency access to all production areas, records, and plant materials for audit, inspection, and testing purposes;
- Developing and implementing a written pest management plan or compliance agreement that fulfills all requirements specified by the program;
- Providing maps of the geographic location of blocks, and planting records that indicate the location of plants under consideration for registration;
- Maintaining all documentation, identification and tagging requirements of the program.

Upon receipt of the signed application, the certifying agency will enter into a dialog with the applying nursery. During this dialog, the certifying agency will conduct an initial program entrance review of the nursery. The review consists of a systems evaluation of the nursery facility, the development of a written pest management plan, and the confirmation of a cooperative agreement between the certifying agency and the nursery.

Please return application form to:

Nursery Certification Officer
Certifying Agency Address

Application for year _____

| | |
|--|--|
| Business Name | Certification Manager |
| Street Address | City, State, Zip |
| Phone Fax | E-mail |
| Alternative Nursery Representative Name Title Phone E-mail | Street Address City, State, Zip |
| Signature, Authorized Nursery Representative | |

Regulatory Review and Approval *Department Use Only*

| | |
|--|---|
| <input type="checkbox"/> Initial program entrance review completed | Signature of certifying agency representative Date |
| <input type="checkbox"/> Approved for participation <input type="checkbox"/> Not approved | Signature of certifying agency representative Date |
| Comments: | |

Annual Continuation of Participation and Notification of Changes

Instructions:

This completed form must be signed by an authorized representative of the participating nursery. The signature indicates that any changes made to specific requirements of the pathogen-tested certification program have been reported to the certifying agency. The certifying agency will follow-up with the primary nursery contact to gather information and record the changes. By completing this form and cooperating with the updating process, participation in the pathogen-tested certification program is continued for another year. If you wish to withdraw from the program, you must notify the certifying agency in writing.

Check those that apply.

Have there been CHANGES:

- In nursery personnel who are responsible parties in the administration of the pathogen-tested certification program?
Please use the form on the back to record personnel changes, attach additional pages if needed.
- To locations and/or planting records of certified sites that require changes to maps?
- To identification and tagging methods?
- To the production or procurement processes listed in the Pest Management Plan?
- To best management practices or standard operating procedures, or any other change affecting the nursery's Pest Management Plan?
- There have been NO CHANGES in the year 20____.

Please return form to:
Certification Officer
Certifying Agency Address

Changes for Year 20__.

Changes in Nursery Personnel

| | |
|--|--|
| Name | Title |
| Reason for Change | Is this person the primary contact for the program? <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Street Address | City, State, Zip |
| Phone | Email |
| Fax | |
| Preferred method of contact: Email Phone (circle one) | |
| Signature, Authorized Nursery Representative Date | |

For Certifying Agency Use

| | |
|--|---|
| <input type="checkbox"/> Changes investigated and recorded | Signature, Certifying Agency Representative Date |
| Comments: | |

Appendix 3 – Certifying Agency Personnel Training and Staff Responsibilities

Certifying Official: The Certifying Official is an employee of the certifying agency vested with the authority and responsibility to approve nurseries that meet the requirements of this certification program and approve or reject plantings/stock enrolled in the program. The Certifying Official may designate qualified personnel to assist in the implementation of different components of the program such as audit, inspection, sampling, or testing of nursery stock. The Certifying Official may only delegate those tasks for which there is a trained, competent, and qualified individual available.

The certifying agency should maintain training records for those working with the program

- Training in program regulations
- Training in field programs and field safety
- Training in laboratory programs and lab safety

Appendix 4. G1 Propagation and Maintenance

G1 caneberry plants are the foundation of the clean stock program, where each plant has tested negative for all the pathogens in Appendix 1 according to approved methods. All G1 material, whether of domestic or foreign origin, will meet the same testing criteria and requirements. Production and maintenance of G1 material must be within a system approved by the certifying official. These plants must be maintained in an approved facility in a protected environment in a prescribed manner to minimize the possibility of infection. All propagules from those plants are G2 unless they follow the guidelines for G1 TC plants. Tissue culture plants propagated from G1 plants may be designated as G1 TC plants, but representative plants must be grown out from tissue culture every year so *in vivo* plants are available for inspection and testing for pathogens covered in this standard and for new viruses that have been identified and for which tests are now available.

Source Material for G1 plants: Candidate G1 should be kept isolated from any other material. Newly established candidate G1 blocks must be tested twice (before and after dormancy following establishment) for pathogens in Appendix 1 and found to be free of these pathogens before they can be designated as G1 plants.

Plants propagated in a screened greenhouse from existing G1 block plants will be eligible for planting in the same G1 block. Newly established G1 blocks must completely tested (before and after dormancy following establishment) for pathogens in Appendix 1 and found to be free of these pathogens prior to entry into this program. All plants in G1 blocks must be tested at least every two years for the pathogens listed in Appendix 1.

Transport of G1 plants between nurseries, will be allowed under the following conditions: If G1 stock is transferred away from the original site, nurseries must follow procedures that are designed to protect the material from pests while loading takes place. Procedures consist of treatments, protective sleeves, covered loading areas, pest-exclusionary loading areas, etc. Loading must take place in a manner that allows no exposure to the outside environment. When moving G1 stock plants, they must be loaded into a solid-sided, sealable shipping container. State regulators must be informed of intention to transport and they may require their presence and phytosanitary documentation for movement. The required G1 testing every 2 years is required after establishment of the new G1 block from the transported plants(s).

The state certifying agency has the authority to review the systems used by a G1 producer. The state certifying agency or their designee must approve a G1 producer before any of its G1 material may be accepted into the state's pathogen-tested certification program.

Site and Physical Requirements for G1 Blocks:

1. G1 plants must be grown in tissue culture or a screenhouse/screened greenhouse that has been inspected and approved for this purpose.
2. The screened greenhouse housing G1 plants must be designed and constructed to preclude pressure from virus-vectoring arthropods and nematodes and must:
 - a. Be at least ten (10) feet from non-certified caneberry species;
 - b. Have a double door to the outside;
 - c. Have screens of a mesh size that will prevent entry of thrips (mesh size of 0.037 inches or smaller);
 - d. Have a footbath or other approved disinfection method at entry points to the screenhouse/screened greenhouse to prevent introduction of soil-borne contaminants. The disinfectant in footbaths must be changed regularly;
 - e. Contain only G1 plants. Candidate G1 plants must be housed separately;
 - f. Have lockable doors with restricted access (recommended);
 - g. Have floors kept clean, free of debris, and weeds;
 - h. Have appropriately labeled compartments to indicate status of material;
 - i. Have a system to provide positive air pressure to entry points to screenhouses/screened greenhouses to minimize entry of insects and pathogens (recommended);
 - j. Be constructed to avoid direct contact of plants with the soil;
 - k. Be surrounded by a 10-foot zone free of undesirable (non-cultivated) plants and weeds around the entire perimeter which may serve as sources for pathogens or pathogen vectors.
3. Equipment used in the propagation and maintenance of G1 stock must be dedicated for this use only or effectively sanitized prior to usage with G1 material.
4. Roadways, receiving areas, media and container storage facilities, propagation, production, and shipping areas and parking areas should be constructed and maintained in such a way that minimizes contact with soil.

Maintenance Requirements: G1 plants must be maintained in a screenhouse/screened greenhouse in an approved manner. Maintenance requirements for G1 blocks are:

1. Disinfection of materials, hands, and tools before each operation and between cuttings or groups of cuttings;
2. Workers must start with the blocks that have the most stringent certification level requirements and proceed downwards through the lower levels;
3. Use of soil-less media, new or sterilized;
4. Use of new or disinfected packaging material for transporting plants;
5. Replacement of capillary mats after each crop;
6. Cultivars or clones should be clearly separated from each other;
7. Recommended horticultural practices should be used to maintain health and vigor of G1 plantings;

8. Regular, sustained pest monitoring (including pathogens, arthropods, and weeds) is required. A written aerial vector control program should be included in the pest management plan or compliance agreement;
9. Removal of flowers before opening;
10. Avoidance of splashing water during watering (recommended).

Testing Requirements: To be eligible for G1 block status and maintaining that status, each G1 plant must be tested every two years at the specified times and have been found free of all organisms specified in Appendix 1.

Inspection Requirements: Each registered G1 plant must be visually inspected by the certifying agency at least twice annually; once in the spring during rapid growth of the plants, and once at another season of the year. Any off-type, diseased, or unusual growth must be recorded and investigated to assure no issues related to the certification program are apparent.

Labeling and Mapping Requirements: Each individual G1 plant must bear a permanent, individual label with the cultivar name, and a unique number that corresponds to a written record for this plant. The nursery must provide a map or GPS coordinates showing the location of the G1 plants within the nursery.

Record Keeping Requirements: Records must include:

1. An inventory of all registered plants in the G1 blocks. See Appendix 12 for suggested format for record keeping.
2. A list of all plants removed from the G1 block or from registration including the specific row and plant location and reason for the removal.
3. Records showing that tests and inspections have been completed in accordance with the provisions of this standard.
4. An inventory showing all of the G2 stock that was distributed from the G1 block. The report shall include the names and addresses of recipients, quantity shipped, date, cultivar, and clone or selection number of the G1 source plants, and should be retained for at least three (3) years from the time of propagation.
5. Records documenting fumigation, treatments and tests for G1 blocks must be kept for at least three (3) years or as required by state law and made available upon request.

Appendix 5 – G2 Propagation and Maintenance

G2 plant material is propagated from G1 stock, or in the case of expanding a G2 block, from a G2 plant in the same block, and is maintained under specific conditions to prevent infection. These plants must be maintained in an approved nursery in protected culture (screenhouse/screened greenhouse, tissue culture) in a prescribed manner to minimize the possibility of infection.

1. Planting Material

Only stock material from G1 sources approved by the certifying agency will be eligible in certified G2 blocks. Prior to planting new material in a certified G2 block, the nursery shall provide the certifying agency with a list of plants to be introduced, bearing the botanical (genus and species) and common names and cultivar identities of the plants. The nursery must maintain records of origin of source materials used in the establishment or expansion of a G2 block for the life of the block.

1.1 Candidate G2 plants

Candidate plants would only be propagated as a specific agreement between the approving agency, Clean Plant Center, the breeder and nursery, and such an agreement would be done on a case-by-case basis. The certifying agency may approve planting of “Candidate G2 plants” under the following special provisions:

- (a) A candidate G1 plant may be identified but not yet eligible for G1 status pending official testing results.
- (b) In the period that pathogen testing is ongoing, propagation material may be taken from the candidate G1 plant and propagated in tissue culture after agreement by the approving agency, with consultation of the certification agency and the nursery.
- (c) If, at the end of testing, the candidate G1 plant qualifies for G1 status, all progeny plants produced from it are also immediately qualified as G2.
- (d) If the candidate G1 plant is found to be infected with a target pathogen during the completion of the testing, all G2 plants derived from the candidate G1 plant will be removed from the certification program.

2. Location

G2 material may be maintained in tissue culture or in a screenhouse/screened greenhouse that have been inspected and approved for this purpose for as long as all appropriate conditions are met.

2.1 Tissue Culture, Screened Greenhouse or Screenhouse

- (a) G2 stock maintained in a screenhouse/screened greenhouse must be indexed every three (3) years for pathogens that are known to spread in the geographic region where the nursery is located (See Appendix 1).
- (b) Appropriate measures and precautions must be taken to prevent the presence of pathogen vectors in screenhouse/screened greenhouse culture of G2 stock.

- a. Be at least 10 feet from non-certified *Rubus* species;
 - b. Have a double door to the outside;
 - c. Have screens of a mesh size that will prevent the entry of aphids;
 - d. Have a footbath or other approved disinfection method at entry points to the screened greenhouse to prevent introduction of soil-borne contaminants. The disinfectant in footbaths must be changed regularly;
 - e. Contain only G2 plants. Candidate G2 plants must be house separately;
 - f. Have lockable doors with restricted access (recommended);
 - g. Have floors kept clean, free of debris and weeds;
 - h. Have appropriately labeled greenhouse compartments to indicate status of material;
 - i. Have a system to provide positive air pressure to entry points to screened greenhouses to minimize entry of insects and pathogens (recommended);
 - j. Be constructed to avoid direct contact of plants with the soil.
- (c) Plantlets (rooted shoots) regenerated from the tissue culture callus are considered G2 plants if they are grown in a screenhouse/screened greenhouse under conditions specified for G2 plants in this standard. The certification will last three (3) years from the date of introduction of plants into the screenhouse/ screened greenhouse.
 - (d) G2 plants in tissue culture used for tissue culture propagation will maintain their G2 status provided all other requirements are met.
 - (e) Screenhouses/screened greenhouses must be designed and constructed to preclude pressure from virus-vectoring arthropods and nematodes. Floors should be kept clean and free of debris and weeds. Direct contact of plants with soil should be avoided.
 - (f) Screenhouses and screened greenhouses must be isolated from field plantings to minimize the risk of introducing pollen and pathogen-vectoring organisms. Planting media must be free of soil-borne vectors of viruses. Tools and supplies must be maintained and disinfected in a way to prevent mechanical transmission of pathogens into the certified material from uncertified materials.
 - (g) Non-certified *Rubus* species or less stringent G level plants must not exist within the G2 level screenhouse/screened greenhouse.

2.2 Buffer Zones

- (a) G2 screenhouses/screened greenhouses must be separated from non-certified plantings of *Rubus* species and from *Rubus* species certified at a less stringent level by an isolation distance of at least ten (10) feet.
- (b) Undesirable (non-cultivated) weeds must be controlled within at least ten (10) feet of the perimeter of the G2 screenhouse/screened greenhouse.

3. Maintenance of G2 Stock:

- (a) Usually propagation of G2 raspberry plants starts with root material or tissue culture directly derived from G1 plants. The roots or tissue culture are used to establish G2 plants.
- (b) Usually propagation of G2 blackberry and its hybrids starts with shoot material or tissue culture directly derived from G1 plants. The shoots or tissue culture are used to establish G2 plants.
- (c) In screenhouse/screened greenhouse culture, G2 plants shall be produced in separate sanitized containers labeled with cultivar name and lot number (if applicable).

- (d) Flowering should be prevented. Blossoms must be removed before they open. In the case of primocane varieties, in which flowering cannot be prevented, the certifying agency may require additional sampling and testing for possible infestations with pollen-borne viruses
- (e) Planting media must be free of pathogens. Tools and supplies must be maintained and disinfected in a way to prevent mechanical transmission of pathogens into the certified material from uncertified materials.
- (f) Recommended horticultural practices should be followed to maintain the health and vigor of G2 blocks.
- (g) Regular, sustained pest monitoring (including pathogens, arthropods and weeds) should be conducted within screenhouses/screened greenhouses (including buffer zones), and appropriate control measures must be applied as described in the nursery's pest management plan or compliance agreement.
- (h) Floors should be kept clean, free of debris and weeds.
- (i) Irrigation water should be uncontaminated or effectively decontaminated (see options in Section 2.4).

4. Inspection, Testing and Labeling of G2 Blocks

- (a) **Inspection Requirements** - Each registered G2 plant must be visually inspected by the certifying agency at least twice annually; once in the spring during rapid growth of the plants, and once at another season of the year. Any off-type, diseased, or unusual growth must be recorded and investigated to assure no issues related to the certification program are apparent.
- (b) **Testing Requirements:** To be eligible for G2 block status and maintaining that status, each G2 plant must be tested at the prescribed times (every three (3) years) if housed in screenhouse/screened greenhouse and have been found free of the organisms in Appendix 1 that are present and spread in the area of production.
- (c) **Labeling and Mapping Requirements:** Each individual G2 plant must be labeled with the variety name, and a unique number that corresponds to a written/electronic record for this plant. The nursery must provide a map or GPS coordinates showing the location of the G2 plants within the nursery.

5. Record Keeping Requirements: Records must include:

- (a) An inventory of all registered plants in the G2 blocks. See Appendix 12 for suggested format for record keeping.
- (b) A list of all plants removed from the G2 block or from registration including the specific row and plant location and reason for the removal.
- (c) Records showing that tests and inspections have been completed in accordance with the provisions of this standard.
- (d) An inventory showing all of the G3 stock that was distributed from the G2 block. The report shall include the names and addresses of recipients, quantity shipped, date, cultivar, and clone or selection number of the G1 source plants, and should be retained for at least three (3) years from the time of propagation.
- (e) Records documenting fumigation, treatments and tests for G2 blocks must be kept for at least three (3) years from the date of application or as required by state law and made available upon request.

Appendix 6 – G3 Propagation and Maintenance

G3 plant material is propagated from G1 or G2 stock and is maintained under conditions specified in this standard for G3 stock to prevent infection. G3 stock may be maintained in tissue culture, in a screenhouse/screened greenhouse, or in the field. The guidelines for maintaining G3 stock in tissue culture or in a screenhouse/screened greenhouse are the same as those for G2 plant material (see Appendix 5) except that blossom removal is not required in G3 plants.

1. Location: G3 Propagation and Maintenance in the Field

G3 stock may be grown and maintained in the field under the following conditions:

- (a) Field plantings must be isolated from non-certified caneberry plantings or separated from blocks of caneberry stock at lower G levels to minimize the risk of introducing virus through pollen and virus vectoring organisms.
- (b) Planting sites must be selected to minimize the introduction of soil-borne viruses from the surrounding land via virus-vector nematodes through drainage, flooding, irrigation or other means;
- (c) For plants grown in the ground, planting sites must test negative for soil-borne vectors within one year prior of planting. If tests are positive, planting sites must be treated for soil-borne vectors by an approved method within one year prior to planting;
- (d) For plants grown in containers, pots should be set on a barrier that prevents the roots of the plants from permeating the soil and prevents direct contact with the soil. This barrier may be plastic, hard-packed clay, pavement, or a minimum of two (2) inches of coarse gravel. The site must be located so as to preclude soil contamination, either directly or through water run-off from drainage, flooding, irrigation, or other means. Nematode testing and fumigation of soil beneath container yards is recommended prior to container yard establishment.
- (e) The site must be inspected for and found free of inocula that cannot be controlled by fumigation, e.g. *Agrobacterium tumefaciens* or *A. rubi*, using methods approved by the certifying agency; The selected site, including a 30-foot buffer zone, must be free of any evidence of the presence of *Agrobacterium* as indicated by the absence of overgrowths or tumors on crowns, roots, stems or leaves, and excessive or abnormal development of organs with or without tumors;
- (f) For plants grown in the ground, the planting site must be on land which has not been used for growing non-certified *Rubus* species or *Rubus* species at a lower certification level, solanaceous plants, and plants that are known hosts of the soil-borne viruses that infect *Rubus* species such as grapevine, fruit trees, blueberry, dandelion, etc. for ten (10) years, or, if the plants are in the ground for less than one (1) year, the entire site must be treated.
- (g) G3 sites do not qualify for certification if tests of broadleaf weeds within the site are positive for soil-borne viruses. Sites will only be approved if corrective measures approved by the certifying agency are undertaken;
- (h) Weeds and other non-certified plants within the planting site, including a 30-foot buffer zone, must be controlled using an approved method.
- (i) G3 stock maintained in the field must be tested every year for the most common pathogens that are known to spread in the geographic region where the nursery is located (see Appendix 1).
- (j) The facility must notify the certifying agency in writing prior to relocating a G3 block for any reason.

2. Buffer Zones for G3 Field Planting Sites

- (a) G3 field plantings must be separated from wild *Rubus* species and all non-certified caneberry plantings or plantings certified at a less stringent level by a distance of 500 feet, or 100 feet if the G3 plants are in the field less than one year (and therefore not flowering). The isolation distance for G3 blocks of primocane flowering varieties is 500 feet.
- (b) The ground in and around G3 field plantings shall be kept either clean cultivated or in an approved, properly controlled ground cover for an isolation buffer distance of thirty (30) feet, or ten (10) feet if the plants are in the ground for less than one year. Weeds must be controlled within the site and the buffer zone. Clean cultivation (no plants other than certified material) is strongly recommended within the site and the buffer zone.

3. Maintenance of G3 Stock in the Field:

- (a) G3 field blocks shall be planted and maintained in a manner, and/or at sufficient distances, so that roots of different blocks do not intermingle.
- (b) Planting media for containerized plants must be free of pathogens. Tools and supplies must be maintained in a way to prevent mechanical transmission of viruses into the certified material from uncertified materials.
- (c) Recommended horticultural practices should be followed to maintain the health and vigor of G3 blocks.
- (d) Regular, sustained pest monitoring (including pathogens, insects and weeds) should be conducted in field blocks (including buffer zones), and appropriate control measures must be applied as described in the nursery's pest management plan or compliance agreement.
- (e) Irrigation water should be uncontaminated or effectively decontaminated (see options in Section 2.4).

4. Inspection, Testing and Labeling of G3 Blocks

- (a) **Inspection Requirements** - Each registered G3 block must be visually inspected by the certifying agency at least twice annually, once in the spring during rapid growth of the plants, and once at another season of the year. Any off-type, diseased, or unusual growth must be recorded and investigated to assure no issues related to the certification program are apparent.
- (b) **Testing Requirements:** To be eligible for G3 block status and maintaining that status, each G3 plant must be tested at the prescribed times and manner (every three (3) years if housed in screenhouse/screened greenhouse, and every year if planted in field blocks) and have been found free of the organisms in Appendix 1 that are present and spread in the area of production.
- (c) **Labeling and Mapping Requirements.** Each G3 nursery block must be clearly labeled with the variety name and a unique number that corresponds to a written record for this nursery block. The nursery must provide a map or GPS coordinates showing the location of the G3 plants within the nursery.

5. Record Keeping Requirements: Records must include:

- (a) An inventory of all registered plants in the G3 blocks. See Appendix ___ for suggested format for record keeping.

- (b) A list of all plants removed from each G3 block with date and reason for removal.
- (c) Records showing that tests and inspections have been completed in accordance with the provisions of this standard.
- (d) An inventory showing all of the G4 stock that was distributed from the G3 block. The report shall include the names and addresses of recipients, quantity shipped, date, cultivar, and clone or selection number of the G1 source plants, and should be retained for at least three (3) years from the time of propagation.
- (e) Records documenting fumigation, treatments and tests for G3 blocks must be kept for at least three (3) years or as required by state law from date of application and made available upon request.

Appendix 7 – G4 Propagation and Maintenance

1. Planting Material

- (a) Only stock material from G1, G2 or G3 sources approved by the certifying agency will be eligible for planting in certified G4 blocks.
- (b) The nursery shall maintain a list of plants in the G4 block including the source of plants and the common names and cultivar identities of the plants.
- (c) If G1, G2, G3 stock for use in G4 production is being supplied by a third party, the nursery must provide documentation from the third party's certifying agency that supports the certification status for all source material obtained.

2. Location

The length of time that G4 material may be maintained in a screenhouse/screened greenhouse or under field conditions will vary depending on the climate in the area of production and testing results.

a. Screenhouse/screened greenhouse

- (a) Screenhouses/screened greenhouses must be isolated by 10 feet from field plantings and wild *Rubus* species to minimize the risk of introducing pollen and virus-vectoring organisms.
- (b) Non-certified *Rubus* species must not exist within the screenhouse/screened greenhouse.
- (c) Screenhouses/screened greenhouses must be designed and constructed to preclude pressure from pathogen-vectoring arthropods and soil-borne vectors (nematodes and fungi).

b. Field

- (a) The site should be isolated from uncertified *Rubus* species (including wild species) by at least 100 feet if plants are not flowering, and 500 feet for primocane varieties and plants that are flowering.
- (b) The planting site must be on land which has not been used for growing non-certified *Rubus* species or *Rubus* species at a lower certification level, solanaceous plants, and plants that are known hosts of the soil-borne viruses that infect *Rubus* species such as grapevine, fruit trees, blueberry, dandelion, etc. for ten (10) years or, alternatively, for G4 blocks that are in the soil for 2 years or less, the entire site must be treated for vector nematodes prior to planting.

- (c) For G4 plants in the ground, the soil should be tested for soil-borne vectors and, if necessary, treated using an approved method within one (1) year prior to planting.
- (d) For G4 plants grown outside in containers, pots should be set on a barrier that prevents the roots of the plants from permeating the soil and prevents direct contact with the soil. This barrier may be plastic, hard-packed clay, pavement, or a minimum of two (2) inches of coarse gravel. The site must be located so as to preclude soil contamination, either directly or through water run-off from drainage, flooding, irrigation, or other means. Nematode testing and fumigation of soil prior to establishment of container yards is recommended.
- (e) Weeds must be controlled within the site and a ten (10) foot buffer zone. Clean cultivation (no plants other than certified material) is strongly recommended within the site and the buffer zone.
- (f) The site must be inspected for and found free of inocula that cannot be controlled by fumigation, e.g. *Agrobacterium tumefaciens* or *A. rubi*, using methods approved by the certifying agency. The selected site, including a thirty (30) foot buffer zone, must be free of any evidence of the presence of *Agrobacterium* as indicated by the absence of overgrowths or tumors on crowns, roots, stems or leaves, and excessive or abnormal development of organs with or without tumors.
- (g) Planting sites must be selected to minimize the introduction of soil-borne vectors and pathogens from the surrounding land through drainage, flooding, irrigation or other means;

3. Buffer Zones

- (a) All vegetation should be controlled within ten (10) feet of G4 screenhouses/screened greenhouses.
- (b) G4 field blocks shall be separated by a distance of one hundred (100) feet from all non-certified *Rubus* species, and, if the plants are flowering, by a distance of 500 feet.
- (c) For G4 field blocks, the ground in and around a G4 block shall be kept clean-cultivated.
- (d) G4 field blocks in the ground shall be planted and maintained in a manner, and/or at sufficient distances, so that roots of different cultivars do not intermingle.

4. Maintenance of G4 Stock:

- (a) In screenhouse/screened greenhouse and field, G4 plants/blocks shall be clearly labeled with cultivar name and lot number (if applicable).
- (b) Screenhouse/screened greenhouse floors should be kept clean and free of debris, potting mix, and weeds. Direct contact of plants with soil should be avoided if the greenhouse has a soil floor.
- (c) For G4 plants grown for one year, flowering is not an issue. Since primocane fruiting cultivars will flower even in the first year, the isolation distance from uncertified *Rubus* for field-grown primocane cultivars must be 500 feet, and a monitoring and control program for thrips must be in place.
- (d) G4 blocks may be harvested for two years, but the harvested plants must be tested each year. The blocks may be used for the second year only if the harvested material from the first year tests clean.

- (e) Planting media must be free of pathogens. Tools and supplies should be maintained in a way to prevent mechanical transmission of systemic pathogens into the certified material from uncertified materials.
- (f) Recommended horticultural practices should be followed to maintain the health and vigor of G4 blocks.
- (g) Regular, sustained pest monitoring (including pathogens, insects and weeds) should be conducted, and appropriate control measures should be applied. A pest management plan or compliance agreement is required.
- (f) Irrigation water should be uncontaminated or effectively decontaminated (see options in Section 2.4).

5. Inspection, Testing and Labeling of G4 Blocks

- (a) **Inspection Requirements** - Each registered G4 block must be visually inspected by the certifying agency at least twice annually, once in the spring during rapid growth of the plants, and once at another season of the year. Any off-type, diseased, or unusual growth must be recorded and investigated to assure that no issues related to the certification program are apparent.
- (b) **Testing Requirements.** To be eligible for G4 block status and maintaining that status, G4 plants will be tested in a manner specified in this standard (see Appendix ____).
- (c) **Labeling and Mapping Requirements** – Each G4 nursery block must be clearly labeled with the variety name and a unique number that corresponds to a written record for this nursery block. The nursery must provide a map or GPS coordinates showing the location of the G4 plants within the nursery.

6. Record Keeping Requirements: Records must include:

- (a) An inventory of all registered plants in the G4 blocks. See Appendix ___ for suggested format for record keeping.
- (b) A list of all plants removed from each G4 block with date and reason for the removal.
- (c) Records showing that tests and inspections have been completed in accordance with the provisions of this standard.
- (d) An inventory showing all of the G4 stock that was distributed. The report shall include the names and addresses of recipients, quantity shipped, date, cultivar, and clone or selection number of the G1 source plants, and should be retained for at least three (3) years from the time of propagation.
- (e) Records documenting fumigation, treatments and tests for G4 blocks must be kept for at least three (3) years or as required by state law from date of application and made available upon request.

Appendix 8 – Containerized Plants

Containerized plants must meet all respective G-level requirements. There are several additional considerations specific to the production of containerized plants.

Containers – containers must be new or sanitized using methods approved by the certifying agency

Growing Media – characteristics of the growing medium can be important to virus certification issues. Media should be free of pathogens covered in this standard and their vectors.

Media may include, but are not limited to:

- Expanded or baked clay pellets, ground coconut husks, coffee hulls, cocoa pods, rice husks, peat, perlite, pumice, sawdust, sphagnum, vermiculite or bark
- Soil that has been tested and found to be free from vectors, or treated with an approved mitigation method prior to use. Soil-less media or a pasteurized media is strongly recommended.

Consideration must be given to the source and suitability of the components of the growing media:

- Samples may be inspected and tested for the presence of vectors
- Media should be mixed and maintained in a manner that precludes it from being contaminated by water runoff carrying soil-borne vectors or windblown seeds
- To the extent possible, the media should be free of plant seeds

Location

Containerized plants should be on a bench above the soil/floor or set on a barrier that prevents the roots of the plants from permeating the soil and prevents direct contact with the soil. This barrier may be plastic, hard-packed clay, pavement, or a minimum of two (2) inches of coarse gravel. The site must be located so as to preclude soil contamination, either directly or through water run-off from drainage, flooding, irrigation, or other means.

Weeds must be controlled in and around the containerized plant site, and in the growing media within the containers.

Tracking

A typical weather-resistant label attached directly to the plant bearing its certification status is highly recommended; however, any weather-resistant identification method (stickers, paint, pot color, rubber tape, etc.) approved by the certifying agency may be used. If another identification method other than labeling is used, then the nursery's records must include all required information, the current location assignment of the containerized plants, and the specific link to the chosen identification method. The method of identification must uniquely delineate certified plants from non-certified plants.

Appendix 9. Pest Management Plan/Compliance Agreement: Nursery Sanitation and Pest Management

General considerations: The participating nurseries will produce and implement a pest management plan or compliance agreement that addresses the measures they apply to prevent pathogen introduction into their certified plantings. This is a written description of procedures or processes designed to eradicate, control, or suppress pest populations to a level that meets this pathogen-certification standard.

Just as the risk of certain viruses varies due to geographical differences affecting vectors and conditions of virus transmission, so too will each facility's pest management plan/compliance agreement vary due to regional differences. A facility's plan will include procedures for the removal and destruction of plants that are diseased or deemed at risk by the certifying agency. This plan must be reviewed and approved by the certifying agency; major revisions to a plan must also be submitted for approval.

General pest management practices, while not directly related to this pathogen-tested certification program, may impact the status of the certified material. While the pest management plan/compliance

agreement produced under this program specifically deals with the critical control points listed above, the certifying agency has the authority to require any additional practice or documentation it deems necessary for the verification of certification status.

The pest management plan/compliance agreement will address the following critical control points and describe the best management practices and standard operation procedures that will be employed to meet the standard:

1. **Source material procurement** – this section must include a flow diagram or written description of the nursery’s procurement process for incoming nursery stock of the listed genera for inclusion in this certification program. For inspection purposes, the inspector will need to access original records from the procurement process. Original records may differ depending upon the G-level of the nursery stock. However, to protect potential confidential business information, a summary of the procurement process is adequate for purposes of the pest management plan/compliance agreement.

The points that must be addressed for this critical control point include:

- a. Selection procedures for the source of stock for inclusion in the program and anticipated certification level.
 - b. The system used to track stock of different certification levels as they are received until planting.
 - c. Tracking of certified material of the listed genera in the establishment to maintain identity through production, packing, and distribution of certified stock to customers.
2. **Site selection process for all plantings registered in the certification program** – The certifying agency must approve each site prior to planting. The following factors will be considered in the site review process and must be addressed or the information included in the pest management plan/compliance agreement.

The points that must be addressed for this critical control point include:

- a. Site drainage evaluation
 - b. History of previous crops
 - c. Isolation distances from non-certified plants in the same genus, including commercial and landscape plantings
 - d. Presence and management of soil-borne vectors
3. **Production processes (including propagation) for nursery stock** – This section must include a flow diagram or written description of the nursery’s production processes for the listed genera. This section must address measures to prevent introduction of pathogens into the certified material. For inspection purposes, the inspector may need access to original records of the production processes.

The points that must be addressed for this critical control point include:

- a. Weed control program
- b. Movement of tools, equipment, and personnel among registered plantings
- c. Movement of soil, insect and nematode vectors, pollen, or virus itself via mechanical transmission

d. Irrigation water source/treatment

4. **Additional potential pathways** – each nursery may identify additional potential pathways in the procurement or production processes where pathogens covered in this standard could be introduced. Each additional potential pathway should be noted in the pest management plan/compliance agreement and best management practices or standard operating procedures to address the pathway should be included in the pest management plan/compliance agreement.

Appendix 10. Visual Inspection and Sampling

A. Visual Inspection of Plants

I. Procedure for inspecting caneberries in the screenhouse/screened greenhouse or field:

- a. The grower will regularly inspect plants. All plants that are symptomatic will be removed and destroyed. The grower must keep a log book recording the cultivar and number of plants destroyed and reason for plant removal.
- b. The certifying agency will do at least two (2) inspections during the growing period when the plants are likely to express symptoms of infection by the pathogens covered in this standard.
- c. All plants that are exhibiting symptoms will be flagged by the inspector, and samples will be taken and tested if symptoms are suggestive of infection. If sampled plants are found to be infected, this will trigger additional testing by the certifying agency. The grower will remove all flagged plants immediately after inspection.
- d. All plants will be inspected by the certifying agency for insect vectors; if found, the certifying agency will notify the nursery of the need for a pest management treatment.
- d. The certifying agency may conduct additional inspections.

II. Some reasons for inspection refusal or suspensions:

- a. Plantings heavily infected with pathogens covered in this standard
- b. Planting is in such poor condition that an adequate inspection cannot be made
- c. Previously condemned plants have not been destroyed
- d. Plants are not grown under conditions specified in this standard (for example inadequate isolation distances from non-certified *Rubus* species, broad-leaf weeds not controlled, etc.)
- e. Other reasons as determined by the certifying agency (e.g., safety issues, re-entry intervals, etc.)

B. Sampling Procedures for Caneberry Certification

Samples must be identified in a manner that enables trace-back to the specific block, clone or plant from which they were collected.

Samples must be collected by the certifying agency in a manner that assures appropriate chain of custody from the nursery to the laboratory and traceability to the individual plant or block in the screenhouse/screened greenhouse or field.

Samples must be protected during collection, transport, and storage from conditions that might interfere with pathogen detection or sample integrity, and sent as soon as possible to an officially approved laboratory for analysis.

C. Diagnostic Tests for Caneberry Pathogens include herbaceous indexing, graft indexing, ELISA and PCR.

All G1 plants are tested at least every other year for all listed organisms in Appendix 1.

All G2 plants are tested at least every three (3) years for all pathogens on the list in Appendix 1 that are present and spread in the area of production.

G3 blocks in the screenhouse/screened greenhouse are tested every three (3) years and G3 blocks in the field every year (at the end of the season) at the 95% confidence level for 1% infection* for all pathogens on the list in Appendix 1 that are present and spread in the area of production.

G4 blocks in the screenhouse/screened greenhouse tested every three (3) years and G4 blocks in the field/container yard tested in the year prior to sale at the 95% confidence level for 5% infection* for the viruses on the list in Appendix 1 that are most likely to spread in the region of production (canary viruses).

For G1 plants in tissue culture, a representative plant(s) is taken out of tissue culture and established in a greenhouse for at least twelve (12) weeks before inspection and testing as described for registered caneberry plants at the specified G level.

Based on International Standard of Phytosanitary Measures (ISPM) No. 31, Methodologies for Sampling of Consignments. 2008. Table 1. Table of minimum sample sizes for 95% and 99% confidence levels at varying levels of detection according to lot size, hypergeometric distribution.

Example: G4 at 95% confidence level for 5% infection if samples from 5 plants can be bulked for ELISA tests:

>10,000 plants will require 59 samples, and with bulking of samples, 12 ELISA tests.

1,000 – 9999 plants will require 57 samples, and with bulking of samples, 12 ELISA tests.

100 – 999 plants will require 45 samples, and with bulking of samples, 9 ELISA tests.

Example: G3 at 95% confidence level for 1% infection:

>10,000 plants will require 294 samples, and with bulking of samples, 59 ELISA tests

1000 – 9999 plants will require 258 samples, and with bulking of samples, 52 ELISA tests

100 – 999 plants will require 95 samples, and with bulking of samples, 19 ELISA tests

Appendix 11: Nursery Field Map and Inventory List Guidelines

For field maps include:

- Field location and orientation
- Nearby roads and adjacent fields (for orientation)
- Grounds maintained (mowed, weeds removed, clean cultivated)
- Rows labeled

For inventory lists include:

- New plants added
- Quantity of plants in each cultivar
- Row length or bed sizes

There are many formats that convey all the necessary information. These can be legibly hand-drawn, computer generated, or entered into a software program for nursery inventory management.

Appendix 12. Inspection Checklists and Forms....under development

- A.** The facility must maintain records on its premises for a period of time established by the certifying agency, and must update critical records within a time frame agreed upon with the certifying agency. The facility must make these records available to the agency upon request.
 - a) Records indicating botanical (genus and species) and cultivar names, certification level, date of introduction of stock to the facility, field name, nursery row planting and accession number. Facilities are encouraged to develop systems that would allow identification of sources for caneberry plants that would trace back to individual source plants, or smaller groups of plants.
 - b) Copies of certification of pathogen-testing received with incoming plant material.

- c) Data collected from monitoring, control or eradication of disease and surveillance activities and dates.
- d) The nursery's written pest management plan or compliance agreement and any records generated through implementation of the plan.
- e) Maps or planting records of the facility indicating the geographical location of blocks, and the location of certified caneberry plants within the blocks.
- f) Records of sale and purchaser's identity, for all wholesale or commercial sales.
- g) Records maintained for other regulatory purposes (e.g. general phytosanitary documents, pesticide records) must be available for inspection and audit if the certifying agency deems it necessary to ensure pathogen status of material.

B. Nursery evaluation checklist – under development

Nurseries should be able to see and use the nursery evaluation checklist themselves, to make sure they are prepared for a nursery evaluation.

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Appendix 13. Aspects of virus transmission to *Rubus* species from internal or external sources in the nursery setting (for viruses that are present in the US).

| | Vector | Vector movement | Seed transmission | Transmitted by pollen | Mechanically transmissible | Time of highest risk of transmission | Alternate hosts (in addition to <i>Rubus</i> species) |
|--|--|-----------------------|----------------------|-----------------------|---|--------------------------------------|--|
| Viruses | | | | | | | Wide host range |
| Apple mosaic virus | | | ? | ? | | | |
| Arabis mosaic virus | Nematode | In soil, on machinery | Yes | | | | Wide host range |
| Beet pseudo-yellows virus | Whiteflies | Aerial | | | | Periods of whitefly activity | Wide host range including cucurbits, beet, strawberry |
| | | | | | | | |
| Black raspberry necrosis virus | Aphids | Aerial | Not in red raspberry | No | With difficulty | Periods of aphid activity | None ? |
| Blackberry calico virus | None known, but spreads rapidly in the field in OR | | | | | | |
| Blackberry chlorotic ringspot virus | | | | | Yes, to <i>Nicotiana occidentalis</i> subsp. <i>Oblique</i> | | |
| Blackberry leaf mottle virus | | | | | | | |
| Blackberry vein banding associated virus | | | | | | | |
| Blackberry virus E | | | | | Attempts unsuccessful so far | | |
| Blackberry virus F | | | | | Yes, to <i>Nicotiana</i> | | <i>N. rustica</i> , <i>N. tabacum</i> , <i>Chenopodium quinoa</i> , <i>Cucumis</i> |

| | | | | | <i>rustica</i> | | <i>sativus</i> |
|---|--|--------|--|------------------------------|--------------------------------|--------------------------------|----------------|
| Blackberry virus S | | | | | | | |
| Blackberry virus X | | | | | Attempts unsuccessful so far | | |
| Blackberry virus Y | Spreads aerially in the field, but vector not yet identified | Aerial | | | No | | |
| Blackberry yellow vein associated virus | None identified but spreads in the field | Aerial | | | No | | |
| Cherry leaf roll virus | | | | | | | |
| Cherry rasp leaf virus | | | | | Yes, to many herbaceous plants | | |
| Grapevine Syrah virus 1 | | | | | | | |
| Impatiens necrotic spot virus | Thrips ? demonstrated? | Aerial | | | | | |
| Raspberry bushy dwarf virus | None identified, but may be carried by insects in pollen | | Yes, shown to occur in some <i>Rubus</i> species | Yes, in <i>Rubus</i> species | Yes, to many herbaceous hosts | | Grape |
| Raspberry latent virus | Aphids | Aerial | | | | Periods when aphids are active | |
| Raspberry leaf blotch virus | | | | | | | |
| Raspberry leaf curl virus | Aphids | Aerial | | | No | Periods when aphids are active | |

| | | | | | | | |
|--|---|---------------------------|----------------------------------|--|--|---------------------------------------|--|
| Raspberry leaf mottle virus | Aphids | Aerial | | | No | | |
| Raspberry ringspot virus | Nematode | Soil, on machinery | | | | | |
| Raspberry vein chlorosis virus | Aphids | Aerial | | | | Periods when aphids are active | |
| Rubus yellow net virus | Aphids | Aerial | | No | No | Periods when aphids are active | |
| Sowbane mosaic virus | | | | | | | |
| Strawberry latent ringspot virus | Nematode | Soil, on machinery | | | | | Wide host range |
| Strawberry necrotic shock virus <i>aka</i> as Black raspberry latent virus | Thrips via pollen movement in other crops | Aerial | Yes | Yes, to the mother plant and to the seed | Yes, to herbaceous indicator hosts | | |
| Tomato black ring virus | Nematode | Soil, on machinery | | | | | Wide host range |
| Tobacco ringspot virus | <i>Xiphinema</i> species Pollen-borne in other crops, thrips or bees | In the soil, on machinery | Yes, in many weed and crop hosts | Yes, to seed in some hosts | Yes, to many herbaceous indicator hosts | When nematodes are present and active | Many alternate weed and crop hosts such as dandelion, grapes, etc. |
| Tomato ringspot virus | <i>Xiphinema</i> species | In the soil, on machinery | Yes, in many weed and crop hosts | Yes, to seed in some hosts | Yes, to many herbaceous indicatory hosts | When nematodes are present and active | Many alternate weed and crop Hosts such as dandelion, grapes, cherries, etc. |
| Bacteria | | | | | | | |

| | | | | | | | |
|--|---|----------------------|----|----|-----------------------|--|------------------------------------|
| Crown gall bacterium | Present in contaminated soil | Soil and water borne | | | Yes, on pruning tools | When plants are wounded by machinery, insects, handling and exposed to infested soil | Numerous crop and weed hosts |
| <i>Xylella fastidiosa</i> | Sharpshooters and spittle bugs – putative | Aerial | No | No | | During periods of vector activity | |
| Phytoplasma | | | | | | | |
| Rubus stunt | Leafhopper | Aerial | No | No | No | During periods of vector activity | Restricted to <i>Rubus</i> species |
| Black raspberry witches' broom phytoplasma | Leafhopper | Aerial | No | No | No | Time of vector activity | |

Appendix 14: Caneberry Buffer Zones and Isolation

| Generation Level | G1 | G2 | G3 | G3 | G4 | G4 |
|---|---|---|---|--|--|------------------------------------|
| Location | SH/SGH [#] | SH/SGH | SH/SGH | Field/Container Nursery Yard* | SH/SGH | Field/Container Nursery Yard* |
| Isolation distance from uncertified <i>Rubus</i> | 10 ft SH/SGH must contain only G1 plants | 10 ft SH/SGH must contain only G2 plants | 10 ft SH/SGH must contain only G3 plants | 500 ft 100 ft if plants are in field for less | 10 ft No uncertified <i>Rubus</i> in SH/SGH | 100 ft 500 ft for primocane |

| | | | | | | |
|---|---|--|--|--|---------------------------------------|--|
| | | | | than one year Primocane flowering cultivars always 500 ft | | flowering cultivars |
| Isolation distance from broad leaf weeds | 10 ft | 10 ft | 10 ft | 30 ft 10 ft if the plants are in the ground for less than one year | 10 ft | 10 ft |
| Flower removal | Yes THRIPS control | Yes THRIPS control Primocane flowering cultivars may require additional sampling and testing | Yes THRIPS control Primocane flowering cultivars may require additional sampling and testing | If in ground less than one year, they don't flower If plants are in the ground for more than one year and the plants are flowering, thrips control is required. Primocane flowering cultivars require thrips control and may require additional sampling and testing | THRIPS control | THRIPS control |
| # years allowed in blocks | Indefinitely, but must be tested every other year as required by standard | Indefinitely, but must be tested every 3 years | Indefinitely, but must be tested every 3 years | Limit of one propagation cycle (up to two years). Tested at end of propagation cycle. | Indefinitely, if tested every 3 years | Limit of one propagation cycle (up to two years). Tested at end of propagation cycle when harvested. |
| No. years since | NA | NA | NA | For plants in the | NA | For plants in the |

| | | | | | | |
|--|---|---|---|--|---|--|
| <p><i>Rubus</i> species, <i>Rubus</i> species at a lower certification level, solanaceous plants, and plants that are known hosts of the soil-borne viruses that affect <i>Rubus</i> species such as grapevine, fruit trees, blueberry, dandelion, etc.</p> | | | | <p>ground: 10 years, or the entire site must be treated if plants are in the ground for less than one year.</p> <p>For plants in container yards: not applicable.</p> | | <p>ground: 10 years, or the entire site must be treated.</p> <p>For plants in container yards: not applicable.</p> |
| <p>Soil contact</p> | <p>Direct contact with soil must be avoided</p> | <p>Direct contact with soil must be avoided</p> | <p>Direct contact with soil must be avoided</p> | <p>For plants in the ground: Planting sites must be tested for soil-borne vectors within one year prior to planting and site fumigated if tests are positive.</p> <p>For plants in container yards: not applicable</p> | <p>Direct contact with soil must be avoided</p> | <p>For plants in the ground: Planting sites must be tested for soil-borne vectors within one year prior to planting and site fumigated if tests are positive.</p> <p>For plants in container yards: not applicable</p> |

*If Blackberry yellow vein virus in region, no G3 or G4 plants in the field

SH/SGH – screenhouse/screened greenhouse