Pathogen-Tested Certification Program for Blueberry

Nursery Stock Production Systems

Index

State Level Model Regulatory Standard

Pathogen-Tested Certification Program for

Blueberry Nursery Stock Production Systems

DRAFT – January 2016

This model standard was produced
by a working group
funded through a USDA Cooperative Agreement

This is a draft document.

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

Contents

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 *Vaccinium* 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 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 possible 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 *Vaccinium* nursery stock, hereafter referred to in this document as the blueberry certification program. This 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 blueberry. 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 blueberry 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 blueberries, hereafter in this document referred to as the blueberry 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. Blueberry 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

Caruso, F.L. and Ramsdell, D.C. (eds) 1995. Compendium of Blueberry and Cranberry Diseases. American Phytopathological Society, St. Paul, MN. Please note that a new edition of this compendium is being written. APS

Press will publish a companion Image CD with the new edition of the compendium. When available, the 2nd edition should be the resource that is used rather than the first edition.

EPPO (European and Mediterranean Plant Protection Organization), Data Sheet on Quarantine Pests:

Blueberry leaf mottle virus
http://www.eppo.fr/QUARANTINE/virus/Blueberry_leaf_mottle_virus/BLMOV0_ds.pdf

Blueberry scorch virus **http://www.eppo.org/QUARANTINE/virus/Blueberry_scorch_virus/blueberry scorch.htm**

Tobacco ringspot virus
http://www.eppo.org/QUARANTINE/virus/Tobacco_ringspot_virus/TRSV00_ds.pdf

Tomato ringspot virus
http://www.eppo.org/QUARANTINE/virus/Tomato_ringspot_virus/TORSV0_ds.pdf

EPPO Standards, Certification Schemes, Pathogen-Tested Material of *Vaccinium* spp., 1998,
http://archives.eppo.org/EPPOStandards/certification.htm

Glossary of Phytosanitary Terms, 2008. ISPM No. 5, FAO, Rome.
http://www.aphis.usda.gov/import_export/plants/plant_exports/downloads/pimglossary.pdf

Griesbach, J.A., Parke, J.L., Chastagner, G.A., Grunwald, N.J., and Aguirre, J. 2011. Safe Procurement and Production Manual: A Systems Approach for the Production of Healthy Nursery Stock.
http://www.oan.org/displaycommon.cfm?an=1&subarticlenbr=861

International Standards for Phytosanitary Measures (ISPMs), 2009, International Plant Protection Convention, https://www.ippc.int/id/13399

Introduction to Fruit Crops, Rieger, M., Chapter 7, Blueberry *Vaccinium* spp. Taxonomy
http://books.google.com/books?id=vUXKIkjDtAQC&pg=PA105&lpg=PA105&dq=blueberry+taxonomy&source=bl&ots=FZF2cz3L_D&sig=grO82xHNzXv5zxNwKNxV7nLgc4g&hl=en&ei=vIALTfu3EonXnAewtqX4DQ&sa=X&oi=book_result&ct=result&resnum=8&ved=0CEwQ6AEwBw#v=onepage&q=blueberry%20taxonomy&f=false

Martin, R.R., Polashock, J.J., and Tzanetakis, I.E. 2012. New and emerging viruses of blueberry and cranberry. Viruses 4:2831-2852.

Martin, R.R., Recommended Procedures for Detection of Viruses in Small Fruits, USDA-ARS-HCRL,
http://www.ars.usda.gov/SP2UserFiles/person/3602/manuscripts/04RecproceedVirusTestingActaHort.pdf

National Clean Plant Network, http://ucanr.org/sites/natcpn/

National Clean Plant Network Glossary http://nationalcleanplantnetwork.org/Glossary/

National Plant Board, Plant Quarantine, Nursery Inspection, and Certification Guidelines, **http://www.nationalplantboard.org/policy/guidelines.html**

New Zealand Ministry of Agriculture and Forestry, *Vaccinium* (Blueberry and Cranberry) Post Entry Quarantine and Testing Manual, **http://www.biosecurity.govt.nz/files/regs/imports/plants/high-value-crops/vaccinium-testing-manual.pdf**

United States Nursery Certification Program Pilot, Standards for Phytosanitary Measures, USDA APHIS, Plant Protection and Quarantine, 7/2008, **http://www.aphis.usda.gov/plant_health/acns/downloads/USNCP-Standards.pdf**

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 enterprise that formally applies to propagate and sell blueberry 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 groupings 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

Certification program – A comprehensive process established and authorized 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 approved for certification under a specific program

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

Clone – A plant that is the result of asexual reproduction and is genetically identical to the parent

Compliance agreement – Any written agreement between a person or enterprise 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)

Cuttings – Parts that are cut off from a plant and rooted to start new plants. Hardwood cuttings refer to dormant tissue; softwood to growing plant parts.

Director, commissioner, secretary of agriculture – The individual who has the 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) – Serological test for pathogen detection

Flats – Trays with drainage holes

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

G level - 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 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 G1, 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 delivery of plants free of systemic pathogens. The technology 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 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 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 the 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 – Berries (NCPN – B) - A commodity committee of the National Clean Plant Network, created to protect U.S. berry crops and the environment from the spread of targeted diseases and pests 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.

National Plant Board - Organization of the plant pest regulatory agencies of each US state and the Commonwealth of Puerto Rico. The purpose of the national board is to address regional plant board recommendations and to harmonize plant health programs and plant pest prevention and regulation initiatives.

National Plant Protection Organization (NPPO) - An official service aiming to discharge the functions specified by the IPPC. For the United States, the NPPO is USDA.

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 (NAPPO) - 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, this is a term used to mean 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

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, fungi, and phytoplasmas.

Pathogen-tested – Tested for 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

Plugs or plug plants – Plants grown in trays containing multiple cells

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

Propagules – Any material that is used for the purpose of propagating an organism to the next stage in their life cycle

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

Rooted microshoots – Tissue culture plants with well-developed root systems

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 or a regulated non-quarantine pest

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 – See 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, fastidious bacteria

Virus-tested – Tested for 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 blueberry production systems
- Facilitate trade of pathogen-tested blueberry nursery stock

This standard outlines the essential elements of a voluntary 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 blueberry 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 program. No producer, 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

This program includes the certification of several *Vaccinium spp.* that are being grown commercially. The blueberry species covered herein include: northern highbush blueberry (*Vaccinium corymbosum* and *V. australe*), southern highbush (*V. corymbosum* hybrids with *V. darrowii, V. ashei* and other *Vaccinium* spp. grown in subtropical areas), lowbush blueberry (*V. angustifolium*), half-high highbush (*V. corymbosum* x *V. angustifolium*), rabbiteye blueberry (*V. ashei,* a.k.a. *V. virgatum*), and huckleberry (*V. ovatum, V. parvifolium, V. ovalifolium,* and *V. deliciosum*). Additional *Vaccinium* species that are propagated for commercial uses such as cranberries or rootstocks (i.e., *Vaccinium arboreum*), are also eligible for this certification program upon approval by the National *Vaccinium* Certification Board.

1.1.1 Plant Material from an Approved Blueberry Certification Program

Blueberry plant material may be moved into certification if produced under an official certification program that has been evaluated using this standard and approved by the certifying agency. The stock must originate from a recognized domestic or a foreign pathogen certification program that is approved by USDA for import into the United States. The certifying agency must perform an audit inspection as outlined in this standard, including testing samples for the presence of pests listed in the 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 Blueberry Pests

An exhaustive list of the systemic pathogens of blueberry 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 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 Nursery Stock. The accompanying nursery stock is certified to have been produced in compliance with requirements of the National Vaccinium 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 nursery is granting the certifying agency access to all production areas, records, and plant material for audit, 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 audit 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 pathogen 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.

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 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 levels 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 (re)infection.

The certifying agency has the authority to review the systems used by G1-G4 producers. The certifying agency must approve G1-G4 producers before any of its G1-G4 material may be accepted into their state certification program under this standard. Guidelines that function as a basis for approval of G1-G4 material can be found in Appendices 4-7.

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 cycles 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 is 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 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 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. Any vegetatively propagated material used for G4 production shall have originated from a registered G1, G2, or G3 source. Propagation and maintenance (including testing) are described in Appendix 7. G2 plants in tissue culture that are "nursery matured" and G3 plants that are grown for sale for fruit production are considered G4 plants for testing purposes and can only be sold as G4 plants.

2.4 Horticultural Management of Plants at All Certification Levels

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 Screenhouse/Screened Greenhouse Plantings

Screenhouse/screened greenhouses 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.

Screenhouses/screened greenhouses 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

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 blocks in the field (planted in the ground) must only be planted on land which has been free from non-certified *Vaccinium* species and other known hosts for soil-borne viruses that affect *Vaccinium* species (dandelions, peaches, grapes, cherries, etc.) for 10 years. The requirements for G4 blocks are the same as G3 blocks, or alternatively for G4 blocks that are in the soil for 2 years or less, the entire site must be treated for soil-borne vectors prior to planting. Certified nursery blocks must be located at a specified distance from any non-certified blueberry plants or blueberry plants at lower certification levels as specified in this standard for their respective G-level.

Chosen planting sites must be tested for soil-borne vectors and will not be approved for production if found positive for soil-borne viruses, or for soil-borne virus vectors. Sites that are not initially approved may be re-evaluated if the nursery undertakes 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 the pathogen-tested 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 blueberry 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 blueberry 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 possibility of infection by pollen-borne and vectored pathogens. 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 pathogen certification 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

Templates for a pest management plan and a compliance agreement are available in Appendix 9. A nursery's pest management plan or compliance agreement 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 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 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 materials 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 given 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 pathogen-tested 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 nursery 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-out 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 facility. The labels must be weather-resistant and must distinguish material grown under the pathogen-tested certification program and non-certified material. Labeling may be by any clearly identifiable unit as described in Appendices 4-7. 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-certified blueberry plants must be agreed upon by the nursery 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 pathogen-tested certification program.

2.8 Nursery Evaluation

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

The certifying agency will conduct an initial program entrance evaluation upon application. After a nursery has entered into a cooperative agreement, the certifying agency will conduct at least one 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 nursery evaluations as necessary.

2.8.1 Initial Program Entrance and Systems Evaluations

Nursery evaluations are systematic examinations of the organizational structure, procedures, processes, and resources used within the participating nursery to implement this certification program. The objective of a nursery evaluation is to align the nursery's production system, including its pest management plan or compliance agreement, with the standards of this certification program.

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

The annual nursery evaluation will take place at a time agreed to by the certifying agency and the approved nursery.

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 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 nursery 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 nursery 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 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 certification status of the nursery, block, or blueberry 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 Blueberry 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 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 disease causing 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. Secondarily, 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 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 blueberry certification program, 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 of blueberry 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]**					
Viruses				Pacific NW	Upper MW	South Central	NE	SE	CA	?
Blueberry latent spherical virus			**RT-PCR[e]**	5	5	5	5	5	5	
Blueberry leaf mottle virus (BLMoV)	*Chenopodium quinoa* *Nicotiana clevelandii*	ELISA[d]	**RT-PCR**	4	1	4	3	4	5	
Blueberry mosaic associated virus			**RT-PCR**	2	2	2	2	4	1	
Blueberry necrotic ring blotch virus (BNRBV)	Visual inspection		**RT-PCR**	4	5	5	5	1	5	
Blueberry red ringspot virus (BRRV)			**PCR**	3	2	1	1	1	5	
Blueberry scorch virus (BlScV)		ELISA	**RT-PCR**	1	2	4	1	4	4	
Blueberry shock virus (BlShV)	*Nicotiana clevelandii*	ELISA	**RT-PCR**	1	3	4	1	4	2	
Blueberry shoestring virus (BSSV)		ELISA		3	1	4	2	3	4	
Blueberry virus A			**RT-PCR**	4	1	5	5	5	5	
Cherry leaf roll virus (CLRV)		ELISA	**RT-PCR**	5	5	5	5	5	5	
Peach rosette mosaic virus (PRMV)	*Chenopodium quinoa* *Nicotiana tabacum*	ELISA	**RT-PCR**	4	3	4	3	4	5	
Strawberry latent ringspot		ELISA	**RT-PCR**	5	5	5	5	5	5	

virus										
Tobacco ringspot virus (TRSV)	*Chenopodium quinoa* *Nicotiana tabacum*	ELISA	**RT-PCR**	3	1	1	1	1	5	
Tomato ringspot virus (ToRSV)	*Chenopodium quinoa* *Nicotiana tabacum*	ELISA	**RT-PCR**	1	1	3	1	1	5	
Phytoplasma										
Blueberry stunt phytoplasma			**PCR**	4	2	1	1	1	5	
Bacteria										
Rhizobium radiobacter, Crown gall	Visual inspection for galls			3	1	1	1	1	5	
Xylella fastidiosa		ELISA	**PCR**	4	4	4	4	1	5	

[a] See Appendix 12 for testing guidelines
[b] Bioassay using sap transmission from blueberry to indicator plants
[c] Polymerase Chain Reaction
[d] Enzyme-linked Immunosorbent Assay
[e] Reverse Transcriptase Polymerase Chain Reaction
[f] 1 – 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 blueberry, not in other crops. For those viruses with 5s all the way across the table, the virus has not been found in blueberry in the United States.

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

Martin, R.R., Polashock, J.J., and Tzanetakis, I.E. 2012. New and emerging viruses of blueberry and cranberry. Viruses 4:2831-2852.

Caruso, F.L. and Ramsdell, D.C. (eds) 1995. Compendium of Blueberry and Cranberry Diseases. American Phytopathological Society, St. Paul, MN. Please note that a new edition of this compendium is being written. APS Press will

publish a companion Image CD with the new edition of the compendium. When available, the 2nd edition should be the resource that is used rather than the first edition.

Appendix 2: Pathogen-Tested Certification 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 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 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*

☐ Initial program entrance review completed	Signature of certifying agency representative Date
☐ Approved for participation ☐ 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? ☐ Yes ☐ No
Street Address	City, State, Zip
Phone Fax	Email
Preferred method of contact: Email Phone (circle one)	
  Signature, Authorized Nursery Representative Date	

For Certifying Agency Use

☐ 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 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 including, but not limited to:

- 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 blueberry plants are the foundation of the clean stock program, where each plant has tested negative for all the pathogens listed 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 plants 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 screenhouse/screened greenhouse from existing G1 block plants will be eligible for planting in the same G1 block. Newly established G1 blocks must be completely tested (before and after dormancy following establishment) for pathogens listed in Appendix 1 prior to entry into the 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 or their designee 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 should:
    a. Be at least 10 feet from non-certified *Vaccinium* species;
    b. Have a double door to the outside;
    c. Have screens of a mesh size that will prevent 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 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 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;
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 or effectively sanitized prior to usage with the 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 must be included in the pest management plan or compliance agreement;
9. Removal of blossoms 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 at least every two years at the specified times and have been found free of all organisms specified in Appendix1.

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 facility 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 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 program, 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 screenhouse/screened greenhouse that has been inspected and approved for this purpose as long as all specified conditions are met.

2.1 Tissue Culture, Screenhouse/Screened Greenhouse

(a) G2 stock maintained in a screenhouse/screened greenhouse must be tested at least 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 Vaccinium species;
b. Have a double door to the outside;
c. Have screens of a mesh size that will prevent 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 housed 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 G2 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) Screened greenhouses and screenhouses 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.

(f) Non-certified blueberry plants 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 blueberry species and from blueberries certified at a less stringent level by an isolation distance of at least 10 feet.

(b) Undesirable (non-cultivated) weeds must be controlled within at least 10 feet of the perimeter of the G2 screenhouse/screened greenhouse.

3. Maintenance of G2 Stock:

(a) Usually propagation of G2 blueberry plants starts with cuttings or tissue culture directly derived from G1 plants. The cuttings or tissue culture are used to establish G2 plants.
(b) In screenhouse/screened greenhouse culture, G2 plants shall be produced in separate sanitized containers labeled with cultivar name and lot number (if applicable).
(c) Blossoms must be removed before they open.
(d) 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.
(e) Recommended horticultural practices should be followed to maintain the health and vigor of G2 blocks.
(f) 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.
(g) Floors should be kept clean, free of debris and weeds.
(h) 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 and manner (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 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, screenhouse/screened greenhouse, or in the field (in the ground or in container yards). Because of the risk of infection from soil-borne viruses, it is strongly recommended that G3 plants should be grown in containers.

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: (1) blossom removal is not required for G3 plants, and (2) if plants are grown in a screenhouse/screened greenhouse without aphid-proof screening, the testing and buffer zone requirements are the same as for G3 plants grown in the field in containers .

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 blueberry plantings or separated from blocks of blueberry 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 soil-borne vectors 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 to 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*, 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 selected planting site, including a 30-foot buffer zone, must be on land which has not been used for growing non-certified blueberry species, blueberries certified at a lower level, or plants such as dandelion, grapevine, fruit trees, caneberry, etc. that

are known hosts of the soil-borne viruses that infect blueberry species within the last ten (10) years.

(g) Weeds within the planting site and a 10-ft buffer zone must be controlled using an approved method;

(h) G3 stock maintained in the field must be tested every year for the most common viruses that are known to spread in the geographic region where the nursery is located (see Appendix 1).

(i) 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 non-certified blueberry plantings or plantings certified at a less stringent level by a distance of five hundred (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 distance of thirty (30) feet.

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 systemic pathogens 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) 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.

(f) 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.

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 block 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 Appendix1 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 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 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 plant 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 *Vaccinium* species to minimize the risk of introducing pollen and pathogen-vectoring organisms.
(b) Non-certified *Vaccinium* 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 - Because of the risk of infection from soil-borne viruses, it is strongly recommended that G4 plants are grown in containers.

(a) The site should be isolated from uncertified *Vaccinium* species (including wild species) by at least two hundred (200) feet.
(b) G4 blocks planted in the ground must only be planted on land which has been free from non-certified *Vaccinium* species and other known hosts for soil-borne viruses that affect *Vaccinium* species (dandelions, peaches, grapes, cherries, etc.) for 10 years, or alternatively for G4 blocks that are in the soil for 2 years or less, the entire site must be treated prior to planting.
(c) 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 prior to establishment of container yards is recommended.
(d) For 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.
(e) The ground in and around G4 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.
(f) The site must be inspected for and found free of inocula that cannot be controlled by fumigation, e.g. *Agrobacterium tumefaciens*, 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;
(h) 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.

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 two hundred (200) feet from all non-certified *Vaccinium* species.
(c) For G4 field blocks, the ground in and around a G4 block shall be kept clean-cultivated (recommended) or planted in an approved cover crop for an isolation distance of thirty (30) feet.
(d) G4 field blocks 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 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, soil and weeds. Direct contact of plants with soil should be avoided.
(c) 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.
(d) Recommended horticultural practices should be followed to maintain the health and vigor of G4 blocks.
(e) 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.

5. 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 other 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 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.

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 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 pathogens varies due to geographical differences affecting vectors and conditions of pathogen transmission, so too will each nursery's pest management plan/compliance agreement vary due to regional differences. A nursery's plan will include procedures for the removal and destruction of plants that are diseased or deemed at risk by the certifying agency. A pest management 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 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 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/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 pathogens via mechanical transmission
   d. Irrigation water source/treatment/management

4. **Additional potential pathways –** each nursery may identify additional potential pathways in the procurement or production processes where the 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. Blueberry Visual Inspection and Sampling

A. Visual Inspection of Plants

I. **Procedure for inspecting blueberry stock 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 certifying agency, 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.

e. 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 blueberry plants, 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 Blueberry 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 Blueberry 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 pathogens on the list in Appendix 1 that are most likely to spread in the region of production (canary viruses).

For G1 tissue culture plants, a representative sample is taken out of tissue culture and established in a screenhouse/screened greenhouse for at least twelve (12) weeks before inspection and testing as described for registered blueberry plants at this 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 blueberry plants that would trace back to individual source plants, or smaller groups of plants.

b) Copies of certification of virus-testing received with incoming plant material.

c) Data collected from monitoring, control or eradication of disease and surveillance activities and dates.

d) The facility'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 blueberry 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.

Appendix 13. Aspects of virus transmission to blueberries from internal or external sources in the nursery setting for those viruses found in the U.S.

	Vector	Vector movement	Seed transmission	Transmitted by pollen	Mechanically transmissible	Time of highest risk of transmission	Alternate hosts (in addition to blueberry)
Blueberry shoestring virus	Blueberry aphid, circulative persistent	Aerial		No	With difficulty	When aphids are present and active	None
Blueberry shock virus	None known, but bees move in pollen	Bees move pollen	Yes	Yes	Yes	During bloom period	None
Blueberry scorch virus	Blueberry aphid and other aphids, non-persistent	Aerial	No evidence for		Yes, to some herbaceous hosts	When aphids are present and active	Limited to the genus *Vaccinium* in natural settings, cranberry, huckleberry
Blueberry virus A	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Tobacco ringspot virus	*Xiphinema* species	In the soil, on machinery	Yes, in many weed and crop hosts	Yes, to seed in some hosts	Yes, to many herbaceous hosts	When nematodes are present and active	Many alternate weed and crop hosts such as dandelion, grapes, etc.
Tomato ringspot virus	*Xiphinema* species	In the soil, on machinery	Yes, in many weed and crop hosts	Yes, to seed in some hosts	Yes, to many herbaceous hosts	When nematodes are present and active	Many alternate weed and crop hosts - dandelion, grapes, cherries, etc
Peach rosette mosaic virus	*Xiphinema* species	In the soil, on machinery	Yes, in weeds and grape	No evidence for	Yes, to many herbaceous hosts	When nematodes are present and active	Many alternate weed and crop hosts such as grape, peach, dandelion, etc.
Blueberry leaf mottle virus	None known, but bees move pollen	Aerial	Yes, including in blueberry	Yes, by wind and bees	Yes, to a few herbaceous hosts	During flowering	
Blueberry red ringspot virus	Possibly by aphids and/or mealybugs	Possibly aerial	Likely not		No		Cranberry
Blueberry mosaic associated virus	Probably fungi	Possibly soil-borne fungi			No		
Blueberry necrotic ring blotch associated virus	Possibly mites	Aerial	No			When foliage present	
Blueberry stunt phytoplasma	Sharp-nosed leafhopper and other leafhoppers	Aerial	No	No	No	During periods of leafhopper activity	
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
Xylella fastidiosa	Sharpshooters and	Aerial	No	No		During periods of	

	spittle bugs – putative					vector activity	

Appendix 14: Buffer Zones and Isolation Considerations (SH/SGH = screenhouse/screened greenhouse)

Generation Level	G1	G2	G3	G3		G4	G4	
Location	SH/SGH	SH/SGH	SH/SGH with aphid-proof screening	Field	Container Yard or SH/SGH without aphid-proof screening	SH/SGH with aphid-proof screening	Field	Container Yard or SH/SGH without aphid-proof screening
Isolation distance from uncertified *Vaccinium*	10 ft	10 ft	10 ft	500 ft		10 ft	200 ft	
Isolation distance from broad-leaf weeds	10 ft	10 ft	10 ft	30 ft		10 ft	30 ft	
Flower removal/not allowed to flower	Yes	Yes						
Distance between cultivars	No overlap allowed	No overlap allowed	No overlap allowed	No overlap allowed		No overlap allowed	No overlap allowed	
No. years allowed in blocks	Indefinitely, but must be tested every other year	Indefinitely, but must be tested every 3 years	Indefinitely, but must be tested every 3 years	Indefinitely, but must be tested every year for viruses that spread in region		Indefinitely, if tested every 3 years for viruses that spread in region	Must be tested for viruses that spread in the region during the year prior to sale (time held in the field varies with desired market size and growth rate in region)	
No. years since *Vaccinium* species, *Vaccinium* species at a lower certification level,	NA	NA	NA	10 years for plants in the soil	NA	NA	10 years for plants in the soil for more	NA

and plants that are known hosts of the soil-borne viruses that affect *Vaccinium* species such as grapevine, fruit trees, caneberry, dandelion, etc.							than two years. For plants in the soil for less than two years, the entire site must be treated.	
Soil contact	Direct contact with soil must be avoided	Direct contact with soil must be avoided	Direct contact with soil must be avoided		Direct contact with soil must be avoided	Direct contact with soil must be avoided		Direct contact with soil must be avoided.