

Towards a national certification scheme for *Rubus* in the United States

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Abstract

Guidelines for a National Certification Scheme for *Rubus* in the United States have been drafted and are being evaluated in states with a tradition of *Rubus* propagation. The major components of the guidelines describe the procedures for propagating, testing and maintaining plants at four successive stages of propagation (G-levels) in the certification scheme. Plants will be tested for different sets of viruses based on the G-level and geographic location of the certified nursery. Guidelines for best management practices have been developed based on scientific knowledge and experience of state regulatory agencies and the nursery industry. The ultimate goal of this project is to provide an effective certification scheme that will allow for the interstate movement of commercially important *Rubus* propagation material and facilitate plant exports.

Keywords: blackberry, certification, G-levels, guidelines, raspberry, *Rubus*

INTRODUCTION

One of the concerns for vegetatively propagated crops are diseases caused by systemic pathogens for which there are no effective therapies in the field. These systemic pathogens include viruses, viroids and systemic bacteria (including phytoplasmas) that have an economic impact on nurseries, producers and consumers (Gergerich et al., 2015). For blackberries and raspberries these losses are caused by poor stand establishment, plant decline, lower yields, and reduced fruit quality (Martin et al., 2013). Additionally, expensive control and management procedures for these pathogens are required locally and nationally by state certification programs and *Rubus* nurseries. Starting with pathogen tested plants can greatly enhance the profitability of producers.

The primary means of long-distance spread of these pathogens is movement of infected propagation material. If these pathogens are introduced on infected nursery stock or are endemic in a region, they can be disseminated to *Rubus* nursery plants and fruit production fields by naturally occurring or invasive vectors. A recent review of the virus diseases of *Rubus* (Martin et al., 2013) listed 29 viruses and their associated vectors which included aphids, nematodes, thrips, and whiteflies. In addition to spread by vectors, some of these viruses are transmitted in pollen or seed from infected plants.

In this communication, we describe the proposed pathway to production of healthy *Rubus* nursery plants through the US National Clean Plant Network (NCPN) and state certification programs. This includes a discussion of the efforts that are underway to formulate and harmonize effective nursery certification programs within the United States as well as with global trading partners.

THE NATIONAL CLEAN PLANT NETWORK

The National Clean Plant Network (NCPN) was established in 2008 and currently supports several specialty crops: grapes, fruit trees, berries, citrus, hops, rose and sweet potatoes. The three main objectives of NCPN are to: (1) develop and maintain G1 (foundation) blocks to serve as sources of clean plant material for certification programs; (2) carry out pathogen elimination in asexually propagated crops; and (3) develop state-of-the-art diagnostics for systemic pathogens. A governing board consisting of researchers,



industry representatives, and state regulatory personnel was established for each of the NCPN crops to develop lists of pathogens (viruses, viroids, and systemic bacteria) that need to be tested for each crop, review proposals for funding, and coordinate activities between Centers.

Three of the NCPN centers in Oregon, Arkansas and North Carolina are concerned with the testing, therapy, production and maintenance of high quality G1 *Rubus* plants free of targeted systemic pathogens for distribution to nurseries for propagation and eventual sale to growers. The NCPN centers coordinate with berry breeding programs in the US to test and eliminate targeted pathogens from advanced selections prior to commercial release of new cultivars, and they provide a pathway for introduction of plant material from foreign sources that are fully tested prior to propagation and planting in the US (Figure 1).

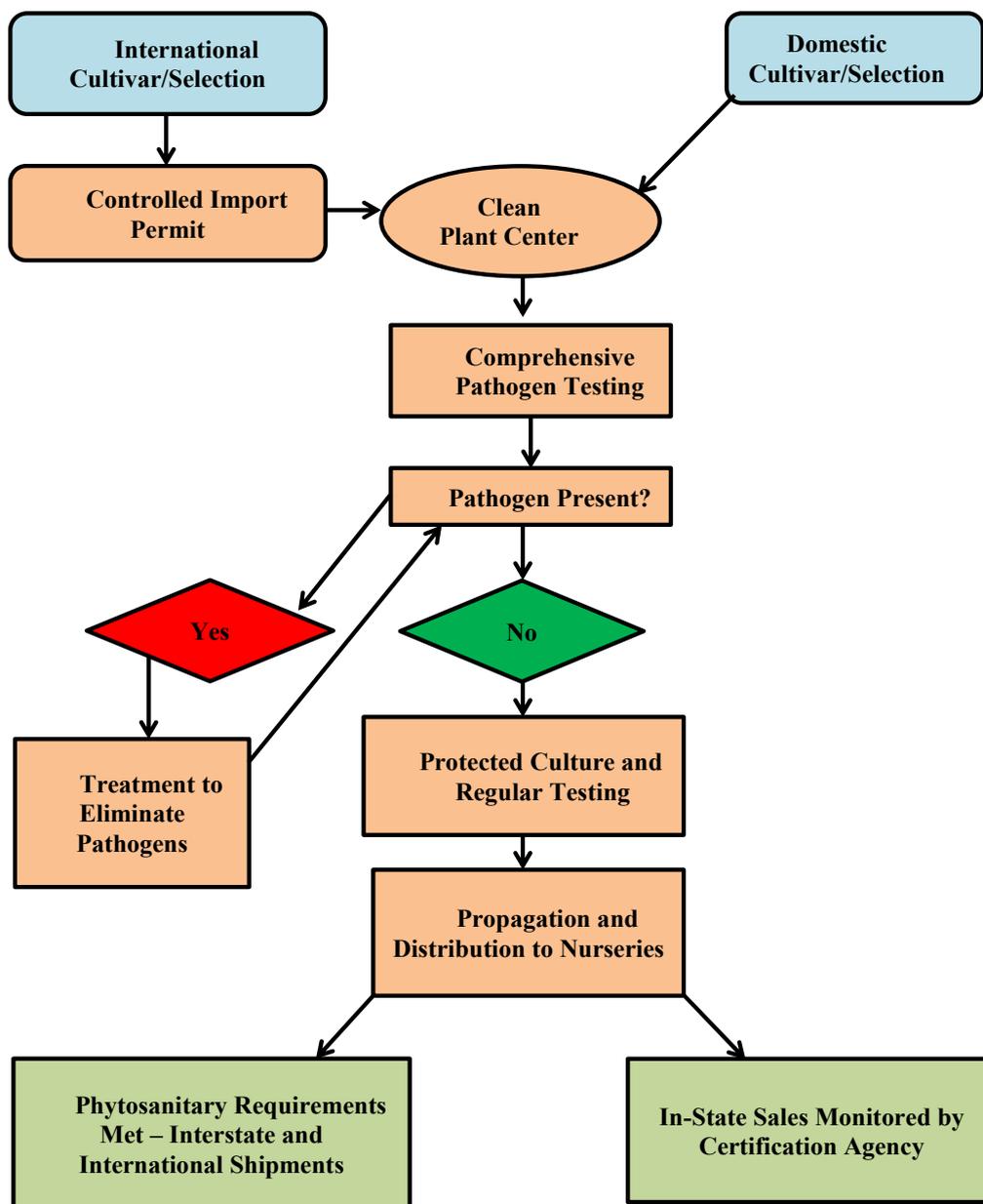


Figure 1. Pathway for production, maintenance and distribution of clean *Rubus* material to producers.

STANDARD TERMINOLOGY AND GLOSSARY

One of the goals of NCPN is to have the NCPN commodities use a standard language for the various levels in certification programs from clean plant centers through the propagation steps in nurseries enrolled in certification programs. To this end, a glossary of commonly used terms has been developed by NCPN (<http://nationalcleanplantnetwork.org/Glossary/>). NCPN has agreed to adopt the G terminology proposed by NAPPO in 2004 (NAPPO, 2012). The use of this simple terminology that numbers generation steps from the top tier plant in a scheme should avoid confusion with the diverse terminology used by different commodities and in different countries (Table 1). Certification levels represent successive generations of propagation from the original tested material (G1), and the phytosanitary measures applied at each G level are established for each level. Eligibility criteria for each G level of *Rubus* propagation have been established including propagation and pest management measures, labeling, record keeping, and the number of generations removed from the original tested material.

Table 1. Explanation of the G-terminology proposed for the stages of plant propagation from clean plant centers (G1) through the propagation steps in nurseries enrolled in certification programs.

Certification level description	Previous terminology	New simplified terminology
Material tested for all targeted pathogens, source for all further propagation	Elite, Nuclear, Mother, Pre-Elite, Foundation, Extra Super Elite, Pre-Basic, etc.	Generation (G)1
Source for all further propagation, propagated from G1 stock	Elite, Foundation, Super Elite, Pre-Basic, etc.	G2
Source for all further propagation, propagated from G2 stock	Registered, Basic, Elite, Increase Block, etc.	G3
Propagated from G2 or G3 stock, sold to producers	Certified	G4

MODEL *RUBUS* NURSERY CERTIFICATION

In the US, the propagation and production of *Rubus* nursery plants for sale is monitored and regulated by State Nursery Certification Programs that vary widely in their requirements. Efforts are underway to develop a model *Rubus* nursery certification standard. The major components of this standard are:

- Published guidelines that define the purpose, terminology, and protocols;
- Sources of “clean” plant material, determined to be free of targeted pathogens;
- Availability of reliable indexing methods for targeted pathogens;
- A system to monitor established standards;
- A means to finance the certification program.

HAZARD ANALYSIS AND CERTIFICATION SCHEMES

The central principle of certification schemes is the application of a systems-based approach that addresses hazards that may allow infection and pathogen spread during propagation. Components of the *Rubus* scheme include: (1) facility and planting site compliance, (2) pathogen testing, (3) scheduled inspections of greenhouse and field grown plants, and (4) isolation distances and vector control. The draft national certification guidelines that have been developed for *Rubus* for implementation in US nursery production systems (<http://www.ncpnberries.org>). This is the result of discussions among scientists who specialize in the pathogens and diseases of *Rubus*, representatives from nurseries who understand the propagation and maintenance of *Rubus* species, including related financial constraints, and the state regulators who are responsible for developing certification standards and monitoring compliance.

The major components of the guidelines describe the procedures for propagating, testing and maintaining plants at four successive stages (generations) of propagation (G-

levels) in the certification scheme. The most stringent propagation and maintenance requirements, and the most comprehensive testing for pathogens are applied to the source plants (G1 level) since these are plants from which all other plants will be derived. Plants will be tested for different sets of viruses based on the G-level and geographic location of the certified nursery. For example, at the G4 level, “canary” viruses that are present and spread readily will be identified for each geographic region, and G4 plants will be tested for these pathogens prior to sale. Guidelines for best management practices have been developed based on scientific knowledge and experience of state regulatory agencies and the nursery industry. Again, the best management practices will be tailored to suit the region in which the plants are being grown. For example, in some regions, the recommendation will be that all plants in the certification stream must be grown in protected culture (tissue culture, screened greenhouse/screenhouse) because of pathogen pressure from endemic pathogen sources.

Successful completion and implementation of these draft certification guidelines will hinge upon: (1) science-based facts to fill in information gaps that prevent educated decisions regarding requirements; (2) a complete and up-to-date database on targeted *Rubus* pathogens and accepted diagnostic tests that is available to regulators, nurseries and growers; (3) outreach programs to educate nurseries and growers about the value of using pathogen-tested plant material; (4) integration of current nursery industry practices in the development of guidelines; (5) ongoing pilot studies of draft guidelines to identify problems with implementation by state agencies and nurseries followed by discussions on how to surmount these difficulties and still preserve the effectiveness of the program.

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