Ministry for Primary Industries
Manatū Ahu Matua

Risk Management Proposal:

Prunus Plants for Planting

28 June 2019

New Zealand Government

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New Zealand Government

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Submissions

The Ministry for Primary Industries (MPI) invites comment from interested parties on the proposed new import health standard for *Prunus* Plants for Planting (i.e. nursery stock). The proposed import health standard is supported by this risk management proposal.

The purpose of an import health standard is defined as follows in section 22(1) of the Biosecurity Act 1993 (the Act): "An import health standard specifies requirements that must be met to effectively manage risks associated with importing risk goods, including risks arising because importing the goods involves or might involve an incidentally imported new organism".

MPI must consult with interested parties in accordance with section 23 of the Act before issuing or amending an import health standard under section 24A of the Act. MPI therefore seeks formal comment on the proposed import health standard.

The following points may be of assistance in preparing comments:

- Wherever possible, comments should be specific to a particular section/requirement of the standard;
- Where possible, reasons, data and supporting published references to support comments are requested;
- The use of examples to illustrate particular points is encouraged.

MPI encourages respondents to forward comments electronically. Please include the following in your submission:

- The title of the consultation document in the subject line of your email;
- Your name and title (if applicable);
- Your organisation's name (if applicable);
- Your address.

Send submissions to: plantimports@mpi.govt.nz.

If you wish to forward submissions in writing, please send them to the following address.

Plant Germplasm Imports
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Ministry for Primary Industries
PO Box 2526
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New Zealand

All submissions must arrive by close of business on 8 August 2019. Submissions received by the closure date will be considered during the development of the final standard. Submissions received after the closure date may be held on file for consideration when the issued standard is next revised/reviewed.

Official Information Act 1982

Please note that your submission is public information and it is MPI policy to publish submissions and the review of submissions on the MPI website. Submissions may also be the subject of requests for information under the Official Information Act 1982 (OIA). The OIA specifies that information is to be made available to requesters unless there are sufficient grounds for withholding it, as set out in the OIA. Submitters may wish to indicate grounds for withholding specific information contained in their submission, such as the information is commercially sensitive or they wish personal information to be withheld. Any decision to withhold information requested under the OIA is reviewable by the Ombudsman.

Summary

(1) This summary gives an overview of the proposed MPI revision to import requirements for *Prunus* plants for planting (nursery stock), as identified in the draft *Import Health Standard: Prunus Plants for Planting* (hereafter referred to as 'the draft standard').

(2) The subject of public consultation is the requirements of the draft standard. This risk management proposal supports the draft standard and should be read in full, and in conjunction with the draft standard, to understand the rationale behind the proposed import requirements and the import health standard development process undertaken by MPI.

Background

(3) *Prunus* plants for planting have previously been imported under the *Prunus* schedule of the MPI Import Heath Standard (IHS) 155.02.06: Importation of Nursery Stock.

(4) MPI has reviewed the *Prunus* schedule of the above standard because the existing requirements are no longer considered appropriate to manage risk, and may not be commensurate with the risk. This can result in ineffective risk management, either because import requirements are too stringent (in relation to the level of risk), or because they do not manage the risk from known regulated pests associated with *Prunus* in accordance with MPI's current appropriate level of protection.

(5) MPI has developed new proposed phytosanitary import requirements in accordance with New Zealand's obligations under the World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures, and taking into account the appropriate level of protection that MPI has established for plants for planting.

(6) The proposed measures have been developed based on information in the *MPI Import risk analysis: budwood/ dormant cuttings of* Prunus *spp*.. The risk analysis is available on the biosecurity consultations page of the MPI website under the heading *Draft import health standard for* Prunus *plants for planting*.

Scope of the draft standard

(7) The draft standard describes the phytosanitary import requirements for importing new commercial varieties of *Prunus* spp. 'stonefruit' (including apricot, cherry, nectarine, peach and plum) and ornamental varieties into New Zealand, for further propagation.

(8) The draft standard applies to dormant cuttings and tissue cultures of all species and hybrids of *Prunus* plants for planting that are listed as permitted in the MPI Plants Biosecurity Index (PBI).

Format of the draft standard

(9) The draft standard has been prepared as a stand-alone document that includes only the phytosanitary import requirements for *Prunus* plants for planting. This is a similar format as the recently issued Import Health Standard for *Actinidia* Plants for Planting, but has been updated in accordance with current generic MPI templates for import health standards.

Screening for regulated pests

(10) The approach taken when developing phytosanitary measures for *Prunus* plants for planting is similar to that applied to other horticultural species under the existing import health standards 155.02.06: Importation of Nursery Stock and *Actinidia* Plants For Planting.

(11) The draft standard proposes some disease screening requirements that were not previously required for *Prunus* plants for planting. This includes applying specific environmental conditions that are likely to be conducive to growth and/or symptom expression of certain types of regulated pests (for example including bacteria, fungi and oomycetes).

a) Such measures are consistent with New Zealand's appropriate level of protection for other classes of regulated pest and take into account the threat posed by these types of pest, including very high risk organisms such as *Xylella fastidiosa*, *Ceratocystis fimbriata* and *Phytophthora ramorum*. Similar measures are in place for other plant genera (for example *Actinidia*) and would likely be applied to other genera when these import health standard schedules are updated;

b) If adopted for *Prunus* plants for planting, similar measures are likely to be applied to other high value crops with similar risk profiles when those standards are reviewed in due course. Therefore, MPI is seeking feedback on these measures from all parties with an interest in protecting New Zealand from biological risk associated with imported plants for planting.

c) These measures, along with alternative measures that MPI has considered for managing risk from these classes of regulated pest, are discussed further in Parts 3.2.2.1 and 4.1.1 of this risk management proposal

(12) Methods used to detect regulated pests whilst they are being screened for disease include:

a) Two plant health inspections per week, by the operator of the facility holding the plants, for the duration of the quarantine period;

b) Ten plant health inspections, by an MPI Inspector, over the duration of the quarantine period;

c) Mandatory testing (for example using polymerase chain reaction [PCR] or culture-based techniques) to detect specified regulated pests (as identified in Schedules 1 and 2 of the draft standard);

d) Diagnostic testing as needed to identify any disease symptoms that are observed whilst plants are in post entry quarantine.

(13) Disease screening requirements are discussed in Part 4.1 of this risk management proposal.

Post entry quarantine

(14) It is proposed that the minimum quarantine period will be 21 months, comprising two growing seasons with a two month period of dormancy between seasons.

(15) Plants will be held in a post entry quarantine greenhouse to prevent any regulated pests escaping into the wider environment.

a) The greenhouse must be approved under the MPI Facility Standard: Post Entry Quarantine for Plants;

b) Plants must be held in a Level 3B greenhouse for the first growing season, but may be transferred to a Level 3A greenhouse for the period of dormancy and the second growing season provided that mandatory testing (as described in Part 4.1.3 of this risk management proposal) demonstrates freedom from all pests that can only be contained within a Level 3B greenhouse.

(16) The proposed requirements for post entry quarantine are discussed in Part 4.2 of this risk management proposal.

Offshore risk management

(17) Part 1.6 of the draft standard gives three options for importing *Prunus* plants for planting into New Zealand, as follows:

a) Plants may be produced under an *Export Plan*;

b) Plants may be produced at an *Offshore Facility*;

c) Plants may be produced in any way other than the options listed above.

(18) When plants are produced at an MPI-approved source using either of the first two options listed above, phytosanitary measures for some (or all) regulated pests listed in the standard will be applied prior to export. MPI will recognise agreed-upon measures as meeting some, or all requirements of the standard. Depending on what measures are applied prior to export, there will be fewer disease screening requirements in New Zealand. This means that the time taken for disease screening in New Zealand may be shorter, and/or may be done in a quarantine greenhouse that provides a lower level of containment than a Level 3B greenhouse. These decisions will be made on a case by case basis.

(19) MPI may require plants produced using one of the first two options to undergo audit testing on arrival in New Zealand to verify the effective application of offshore phytosanitary measures. If this is the case, this testing will be done in a post entry quarantine facility after the plants arrive in New Zealand.

(20) When plants are produced in any other way, all of the measures described in Part 2.3 of the draft standard will need to be applied in post entry quarantine in New Zealand.

(21) More detail about options for offshore risk management are provided in Part 3.2.1 of this risk management proposal.

1. Introduction

1.1 Objective

(22) MPI's objective in developing a new import health standard for *Prunus* Plants for Planting is to ensure that biosecurity risk associated with imported material is managed appropriately to give the New Zealand stonefruit industry, and any other importers, ongoing access to new germplasm.

1.2 Purpose

(23) The purpose of this risk management proposal is to:

a) Summarise the known biosecurity risks that may be associated with imported *Prunus* plants for planting;

b) Show how the measures proposed in the draft standard will appropriately manage biosecurity risks, and are consistent with New Zealand's domestic legislation and international obligations;

c) Provide information to support the consultation on the draft standard.

(24) The risk management proposal is not itself the subject of consultation. However, MPI will accept comments and suggestions on the risk management proposal in order to improve future consultations on import health standards.

1.3 Background

(25) The existing import requirements for *Prunus* plants for planting were established in the *Import Health Standard 155.02.06: Importation of Nursery Stock*, issued in 2004. Before that imports occurred under previous versions of that standard. The import requirements for *Prunus* have been amended several times since 2004, but have never been comprehensively reviewed.

(26) All *Prunus* plants for planting must undergo disease screening to verify that they are free from regulated pests. This can be done either offshore, or on arrival in New Zealand, or a combination of both.

(27) *Prunus* germplasm is one of the most commonly imported genera for use in the production of high value crops in New Zealand.

a) All consignments imported since 2009 have been from MPI-accredited offshore facilities;

b) Under the existing import health standard, the minimum quarantine period for plants from accredited facilities is nine months of active growth in a Level 2 post entry quarantine greenhouse, spread over two growing seasons. As an alternative, plants may be transferred to a Level 1 post entry quarantine site after six months continuous active growth in Level 2. If this is done, the minimum quarantine period is extended to a total of 12 months active growth;

c) Plants that are not from an MPI accredited facility must undergo quarantine in a Level 3B post entry quarantine greenhouse. In this case, the existing standard specifies a minimum quarantine period of 24 months active growth.

(28) Because the New Zealand stonefruit industry relies on ongoing imports of new *Prunus* germplasm to remain competitive, and in recognition of the fact that the existing import requirements have not been reviewed since 2004, MPI has prioritised revising and re-issuing phytosanitary import requirements for this commodity.

1.4 Commodity description

(29) The draft standard applies only to eligible members of the *Prunus* genus (including apricot, cherry, peach, plum, nectarine and ornamental cultivars) that are currently listed in the MPI Plants Biosecurity Index (PBI) with an import specification of "L2, L3 see 155.02.06 under *Prunus*". Interspecific hybrids will be eligible for import, provided that every species in the parentage is identified with the full scientific name (genus and species) and is listed as eligible in the Plants Biosecurity Index.

(30) The following plant parts will be eligible for import:

a) Dormant cuttings;

b) Tissue cultures derived from aerial plant parts.

i. The draft standard defines tissue cultures as 'plants *in vitro* that have been prepared as tissue culture from one parent by asexual reproduction (clonal techniques) under sterile conditions';

ii. "Plants *in vitro*" is defined as 'a commodity class for plants growing in an aseptic medium in a closed container' (in ISPM 5: *Glossary of phytosanitary terms*);

iii. Tissue cultures must be derived from aerial plant parts. The standard will not specify the type of aerial plant parts that may be used, but this can include tissue cultures derived from stems, shoots, leaves, terminal and axillary buds, flowers, petiole segments, anthers, pollen, seeds, embryos and endosperm;

iv. Tissue cultures derived from root or basal stem tissues close to the soil level will not be eligible for import. This is because these types of material were excluded from the scope of the MPI risk analysis for this commodity.

(31) Reference is made to '*Prunus* plants for planting' throughout this document. When this phrase is used, it applies only to dormant cuttings and tissue cultures. In the context of this document, the phrase does not apply to any other types of *Prunus* germplasm (such as whole plants, pollen, or seeds).

1.5 Scope of this risk management proposal

(32) This risk management proposal includes:

a) Background information about MPIs approach to managing risk from plants for planting;

b) A description of generic disease screening measures that will be applied to all *Prunus* plants for planting imported into New Zealand to maximise the likelihood of inducing symptoms of infection by known regulated pests and by unknown risk organisms;

c) A description of specific testing that is proposed to give assurance that imported germplasm is free from regulated pests that may not display visible disease symptoms in post entry quarantine;

d) A discussion on the feasibility and practicality of the proposed risk management measures.

(33) This risk management proposal does not:

a) Identify all regulated species of fungi and oomycetes which MPI considers will be detected by the generic measure of growing season inspection during the proposed minimum quarantine period of 21 months in a Level 3B quarantine greenhouse (as described in Part 4.2 of this risk management proposal);

b) Identify any species of insects or mites that may be associated with the commodity;

c) Identify individual species of phytoplasma that may be associated with *Prunus* plants for planting.

(34) Information in this risk management proposal is based on the MPI risk analysis: budwood/ dormant cuttings of *Prunus* spp. (available on the biosecurity consultations page of the MPI website). Unless a specific reference is included in the text of this risk management proposal, all information is drawn from the content of the risk analysis and all primary references can be found in that document.

1.6 Format of the draft standard

(35) MPI has prepared the draft standard as a stand-alone document that only contains phytosanitary import requirements for *Prunus* plants for planting. This is intended to help ensure that requirements are easy to understand. The format is similar to the format used when developing import requirements for *Actinidia* plants for planting, which were the subject of formal public consultation in 2018, but has been updated to reflect current generic MPI templates for import health standards.

(36) Rather than using the term 'nursery stock', the commodity type is referred to as 'plants for planting'. This change has been made to be consistent with the terminology used in the International Standards for Phytosanitary Measures (ISPM's) as follows.

a) 'Plants for planting' is defined in ISPM 5: *Glossary of phytosanitary terms* as 'Plants intended to remain planted, to be planted or replanted';

b) 'Planting' is defined as 'Any operation for the placing of plants in a growing medium, or by grafting or similar operations, to ensure their subsequent growth, reproduction or propagation'.

(37) Parts 1 – 3 and the Schedules to the draft standard set out all biosecurity requirements for importing *Prunus* plants for planting. The Introduction to the draft standard, and any information contained in guidance boxes, does not form part of the legal requirements, and is intended to provide general information about the draft standard.

(38) The draft standard identifies all priority regulated pests associated with *Prunus* plants for planting that could have a significant adverse impact on stonefruit, other crops and/or the New Zealand environment. For example this includes species such as *Plum pox virus and Xylella fastidiosa*, as well as the genera *Phytophthora* spp. and '*Candidatus* Phytoplasma' spp.. The draft standard also identifies regulated pests that may have a more restricted impact, but that require specific testing to verify their absence. This applies to pests that may not induce visible symptoms on plants in quarantine (for example including certain species of regulated virus that are restricted to the *Prunus* genus). All of these pests, and the required testing measures, are listed in Schedules 1 and 2 of the draft standard.

a) A full list of regulated pests is identified in BORIC [note: the full list will eventually be listed in the new PIER (Plant Import and Export Requirements) tool, currently being developed by MPI];

i. If detected in imported *Prunus* plants for planting, MPI will identify the causal agent of disease symptoms and confirm their regulatory status by reference to the MPI Biosecurity Organisms Register for Imported Commodities (BORIC) database, not the import health standard;

ii. If symptoms are caused by an organism that is not listed in BORIC, the MPI Chief Technical Officer (CTO) will make a decision on the regulatory status of that organism, and will update BORIC accordingly;

iii. This reflects the approach taken in the risk analysis, where MPI undertook a 'selected hazard identification' for fungi and oomycetes. The hazard identification did not attempt

to identify all known fungi and oomycetes which should be regulated pests of *Prunus*. This is because the generic disease screening measures proposed in the draft standard are considered sufficient to manage risk from many fungi and oomycetes in accordance with MPI's appropriate level of protection, regardless of whether the organism is listed in the standard.

b) A risk assessment cannot identify all possible pests of concern because unexpected pest associations occur. This is one of the reasons plants for planting require post entry quarantine. Therefore, regulated pests unlikely to display visible signs or symptoms unless plants are screened for disease in post entry quarantine, are not generally listed in the standard, but are instead listed in BORIC. In particular, this applies to most species of fungi and oomycetes. These pests will be effectively contained within a Level 3B quarantine greenhouse. Similarly insects and mites, for which generic treatments are applied to manage the risk, are very unlikely to be associated with plants for planting, so are also not listed in the standard but are listed in BORIC. If insects or mites are observed during inspections by an exporting country NPPO, their regulatory status should be determined by reference to BORIC.

(39) Not all pests on plants for planting can be identified by an exporting country NPPO using standard phytosanitary certification procedures (if they do not display visible signs and symptoms). Therefore, unlike goods which receive clearance on arrival (e.g. fresh produce) and that are covered by a phytosanitary certificate which includes a declaration of pest freedom, in an import health standard for plants for planting MPI generally requires additional measures to be applied before granting biosecurity clearance (i.e. screening for disease in post entry quarantine). Disease screening and post entry quarantine requirements proposed for *Prunus* plants for planting are identified in Parts 2.3 and 2.4 of the draft standard.

2. Context

2.1 Domestic

(40) Maintaining plant health is a key outcome of New Zealand's biosecurity system. The system is regulated by MPI, through the Biosecurity Act 1993. Section 22 of the Act describes an import health standard and outlines the types of matters that should be considered in an import health standard.

(41) The biosecurity system in New Zealand operates as a series of components (pre-border, border and post border) that together provide a high level of assurance that regulated pests are unlikely to establish in New Zealand. No one part of the system is able to achieve the necessary protection on its own.

(42) No biosecurity system can reduce risk to zero. This is not feasible, and nor is it desirable. The objective of New Zealand's system is to reduce to an appropriate level the likelihood of unwanted impacts occurring. Within this system, the objective of an import health standard is to effectively manage the risks associated with imported goods in order to reduce to an appropriate level the likelihood of introduction (entry and establishment) of regulated pests (including pests, diseases and weeds).

(43) An organism is 'regulated' by MPI if it could cause unacceptable consequences (i.e. likely to cause unacceptable economic, environmental, socio-cultural or human health impacts in New Zealand) if it were to enter and establish in New Zealand, provided the organism is:

a) Not present in New Zealand; or

b) If present in New Zealand is under official control; and

c) Is able to establish and spread in New Zealand.

(44) Organisms that are present in New Zealand may also be regulated, when found in association with imported goods, if they are known vectors of regulated pests.

(45) When managing biosecurity risks associated with plants for planting a period of time may be required to examine plants for signs and symptoms of regulated pests, or to complete specific testing, before plants can be cleared for entry into New Zealand. Therefore, if specified in an import health standard, plants for planting must be screened in quarantine to ensure that they are free from regulated pests. An import health standard may allow such screening to be done either offshore, or after the plants arrive in New Zealand.

(46) MPI monitors the pathway performance related to each import health standard to ensure biosecurity risks are effectively managed. This is achieved through verification and inspection activities at the border and, where necessary, audits of offshore production systems.

(47) MPI is committed to the principles of transparency and evidence-based technical justification for all new and amended phytosanitary measures imposed on importing pathways.

2.2 International

(48) Where possible, phytosanitary import requirements are aligned with international standards, guidelines, and recommendations[1] as per New Zealand's obligations under Article 3.1 of the World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures; WTO, 1995 (SPS Agreement).

(49) The SPS Agreement sets in place rules that protect each country's sovereign right to take the measures necessary to protect the life or health of its people, animals, and plants while at the same time facilitating trade. It embodies and promotes the use of science-based risk assessments to manage the risks associated with the international movement of goods.

(50) In keeping with New Zealand's obligations under the SPS Agreement and the IPPC (International Plant Protection Convention), phytosanitary measures must:

a) Be scientifically justified and only for regulated pests. The strength of any phytosanitary measure will depend on an assessment of risk, with an emphasis on the consequences of the pest establishing in New Zealand;

b) Not discriminate unfairly between countries or between imported and domestically produced goods;

c) Not be more trade restrictive than necessary;

d) Be based on international standards wherever possible, but WTO members can adopt a measure that is more stringent than an international standard, provided the measure is scientifically justified.

2.3 Strength of measures

(51) Measures are required for regulated pests where the 'probability of introduction (entry and establishment) and spread' on a pathway is unacceptable (i.e. if a regulated pest is able to enter through the pathway, find a suitable host, and establish and spread in New Zealand). For plants for planting proposed for import, the probability of entry is difficult to assess because the IHS covers a wide diversity of material from all countries, including that from commercial facilities with established pest management practices as well as wild-collected plants. However the strength of

[1] Note that international standards, guidelines or recommendations referred to in the WTO agreement are those of Codex, OIE (World Organisation for Animal Health) and the IPPC.

association is noted in the commodity association section of the risk analysis and can be taken into account in the decision. Exposure (transfer to a suitable environment) is assessed as a high likelihood for all associated regulated pests based on previous import risk analyses for plants for planting.

(52) Risk is an assessment of both likelihood (of establishment) and consequence (impact). While measures can only reduce the likelihood of establishment (i.e. do not affect consequence), the greater the risk posed by a pest that will establish and cause unwanted harm, the greater the level of assurance MPI requires that the pest is managed in a consignment. The required strength of a measure depends on the risk posed by a particular regulated pest on a particular pathway and is determined by a combination of the consequences the pest may cause if it was introduced into New Zealand and the likelihood that the pest will enter and establish from a pathway.

(53) Plants for planting is one of the highest risk pathways for the introduction of pests and diseases to new areas (for example as per ISPM 32: *Categorisation of commodities according to their pest risk*). Part of the reason for this is that plant pests can survive in living plant material that does not show any signs of infection/infestation, and the living plant material increases the likelihood of pest survival and hence the likelihood of introduction. Because plants imported for planting may be multiplied and/or widely distributed throughout the country, including in key areas of commercial production, the likelihood of pests surviving and being transferred to suitable domestic hosts is higher than for many other import pathways. This is why, if required in an import health standard, plants for planting must be screened for regulated pests before they are cleared for entry into New Zealand.

3. Risk management approach

(54) This Part of the risk management proposal includes a description of the information used to develop the draft standard, and describes the types of risk management measures that may be applied to plants for planting that are imported into New Zealand.

3.1 Source information

(55) This risk management proposal is based on information in the MPI risk analysis: budwood/ dormant cuttings of *Prunus* spp.. Where information has been used that is not included in the risk analysis, citations are given as footnotes to this risk management proposal.

3.2 Risk management measures

(56) Risk management measures that are considered when developing an import health standard for plants for planting are discussed in this section. These measures can be applied either before export (i.e. pre-border) or at the New Zealand border (including in post entry quarantine).

(57) Because plants for planting present a high biosecurity risk (as noted in paragraph (53)), greater emphasis is put into measures that are applied at the border (including post entry quarantine) than for other commodity types (e.g. fresh produce for consumption). Reasons for this include the following (taken from ISPM 36: *Integrated measures for plants for planting*):

a) Some pests do not cause distinct visual symptoms, particularly at low pest incidence;

b) Symptoms of infestation may be latent or masked at the time of inspection (e.g. as a result of pesticide use, nutrient imbalances, dormancy of plants at time of dispatch, presence of other non-regulated pests or by removal of symptomatic leaves);

c) Small insects or eggs may be hidden under bark or scales of buds etc.;

d) The type of packaging, size and physical state of the consignment can influence the effectiveness of inspection;

e) Detection methods for many pests, particularly pathogens, may not be available.

3.2.1 Pre-border measures

(58) Generic pre-border risk management measures that may be applied include:

a) Commercial production to reduce pest prevalence;

b) Treatment for regulated insects and mites;

c) Official pre-export inspection and phytosanitary certification by the NPPO of the exporting country to verify that pre-export measures have been undertaken and were effective, and that the consignment is free from visibly detectable regulated pests.

(59) As well as the generic risk management measures, specific measures may be applied offshore to manage risk associated with some, or all regulated pests that may be associated with plants for planting.

a) The option for measures to be applied offshore is included in Part 1.6 of the draft standard, which allows Prunus plants for planting to be produced according to an Export Plan, or at an Offshore Facility (see Parts 3.2.1.1 and 3.2.1.2 of this risk management proposal).

b) When specific measures are applied offshore, the plants for planting are likely to have fewer requirements for screening for regulated pests on arrival in New Zealand:

i. This can be advantageous to importers because plants may be able to be held in a lower level of quarantine facility on arrival in New Zealand, and/or have a shorter quarantine period (in recognition of measures that are applied offshore). This may result in lower import costs and more rapid clearance of goods.

ii. The requirements for screening for regulated pests on arrival in New Zealand, along with the level of post entry quarantine and the length of the quarantine period will depend on the number and type of phytosanitary measures that are applied offshore;

iii. These measures will be evaluated when an *Export Plan* is agreed, or when an *Offshore Facility* is approved;

iv. Phytosanitary measures that must be applied in New Zealand will be identified in the import permit for each consignment (as discussed in Part 5.1 of this risk management proposal).

(60) Audit testing may be required after plants arrive in New Zealand to verify the effective application of phytosanitary measures that were applied prior to export. If audit testing is required, plants may need to be held in post entry quarantine until testing is completed. Any audit testing requirements will be identified when MPI agrees on an *Export Plan* or approves an *Offshore Facility*.

3.2.1.1 Production according to an Export Plan

(61) An *Export Plan* is an agreement between MPI and the NPPO of the exporting country that describes all activities that support the effective application of phytosanitary measures that are applied prior to export.

a) An *Export Plan* will not be agreed upon until a CTO is satisfied that it meets New Zealand's expectations for biosecurity;

b) An *Export Plan* must be agreed before imports can commence;

c) Any countries with an *Export Plan* for *Prunus* plants for planting will be identified in the MPI online system;

d) There are no *Export Plans* in place for *Prunus* plants for planting at the time of writing this risk management proposal.

(62) A combination of the following measures may be included in an *Export Plan* to manage biosecurity risk associated with some, or all, of the regulated pests associated with *Prunus* plants for planting:

a) Country freedom, where a CTO is satisfied that a country has country freedom status in relation to a particular pest. To ensure country freedom, measures described in ISPM 8: *Determination of pest status in an area* and ISPM 4: *Requirements for the establishment of pest free areas* must be applied by the exporting country;

b) Production in a pest free area, using systems to establish and maintain freedom as described in ISPM 4: *Requirements for the establishment of pest free areas*;

c) Pest free place of production under the supervision of the NPPO of the exporting country, as described in ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites*;

d) The use of Integrated measures for plants for planting under the supervision of the NPPO of the exporting country, as described in ISPM 36: *Integrated measures for plants for planting*.

3.2.1.2 Production in an MPI approved offshore facility:

(63) MPI can approve an *Offshore Facility* to undertake some (or all) of the testing for regulated pests that would otherwise be done in post entry quarantine in New Zealand;

(64) Offshore facilities must be accredited to the MPI Standard PIT-OS-TRA-ACPQF: Accreditation of Offshore Plant Quarantine Facilities and Operators. Note that this standard is currently under review and MPI expects to consult on a revised version soon;

(65) More information about offshore facilities can be found on the MPI website at http://mpi.govt.nz/news-and-resources/resources/registers-and-lists/offshore/.

3.2.2 Measures and verification activities at the border

(66) Measures and verification activities undertaken at the border include:

a) Inspecting documents to verify that the phytosanitary certificate, and other associated documents, comply with the requirements of the standard;

b) Inspecting plants at the place of first arrival to verify freedom from visible pests. For horticultural crops, it is expected that all plants will be inspected on arrival at the border;

c) Remedial action (for example treatment) if a regulated pest is detected during the on-arrival inspection, or if any required treatments were not applied prior to export;

d) Screening plants in post entry quarantine, using some or all of the following measures:

i. Inspecting for signs and symptoms of regulated pests;

ii. Diagnostic testing to verify whether a regulated pest is present in plants showing signs or symptoms of diseases;

iii. Growing plants under environmental conditions conducive to disease development (see part 3.2.2.1);

iv. Mandatory testing (for example using biological indexing, microbial culturing, or polymerase chain reaction [PCR]) to detect asymptomatic regulated pests.

(67) The following factors are considered when determining the disease screening measures that will be applied, the length of the quarantine period, and/or the type of post entry quarantine facility in which the plants must be held:

a) Likelihood of entry of a regulated pest on a particular import pathway:

i. Whether a particular regulated pest is likely to be associated with the plant parts being imported (for example tissue cultures vs. cuttings vs. whole plants);

ii. Presence or absence of the quarantine pest in the exporting country (for example if a CTO is satisfied that a country has country freedom status in relation to a particular pest and this can be endorsed on a phytosanitary certificate in accordance with the relevant ISPM);

iii. Whether material is produced under an *Export Plan* or at an *Offshore Facility*;

iv. Available treatment methods (for example insecticide or miticide before plants enter quarantine).

b) Pathogen biology:

i. Mode of transmission;

ii. Whether vectors are present (or likely to be present) in New Zealand;

iii. Whether vectors are likely to be present in close proximity to the quarantine facility;

iv. Whether the same (or related) species as the imported plants, or other known host species, are likely to be present in close proximity to the quarantine facility;

v. Epidemiological characteristics.

c) Available disease screening methods (for example growing season inspection, biological indexing, PCR);

d) Likelihood of establishment of a quarantine pest via an import pathway;

e) Potential environmental, economic, human health and/or socio-cultural consequences of establishment.

3.2.2.1 Risk management options for bacteria, fungi and oomycetes in post entry quarantine

(68) When developing new import requirements for *Prunus* plants for planting, MPI considered whether similar measures to those in the existing standard will manage risk from bacteria, fungi and oomycetes to an appropriate level, or whether alternative measures could be applied to provide a higher level of risk management.

(69) Risk management options for bacteria, fungi and oomycetes were considered in detail here because, under the existing import health standard, these classes of organism generally have less stringent disease screening requirements in post entry quarantine than other classes of regulated pest (such as phytoplasmas, viroids and viruses). This means that the level of protection may be inconsistent between different classes of regulated pest. Three risk management options were considered, as follows:

a) Maintaining the status quo, with similar measures to those in the existing *Prunus* standard;

b) Applying specific environmental conditions in post entry quarantine to increase the likelihood of detecting various regulated pests;

c) Maintaining the status quo, but with more comprehensive mandatory testing requirements.

(70) The risk management options identified above are discussed in the following sections. Specific measures proposed for *Prunus* plants for planting are described in Part 4 of this risk management proposal.

(71) Risk management options for other classes of regulated pest (for example including phytoplasmas, viroids and viruses) have not been considered in this part of the risk management proposal. This is because, for these classes of organism, existing measures are considered to manage the risk to an appropriate level (as discussed elsewhere in this risk management proposal).

(72) Taking into consideration information in the following sections, MPI is seeking specific feedback on the following:

a) Whether existing risk management measures for bacteria, fungi and oomycetes (as described in Part 3.2.2.1.1) manage risk to an appropriate level.

   When considering this, it is noted that there is no evidence of any regulated pest incursions in New Zealand being attributed to imports of plants for planting imported under measures in the existing Import health standard for importation of nursery stock;

b) If existing measures do not manage risk to an appropriate level, what alternative measures should be considered to achieve a higher level of risk management.

   When considering the alternative options identified in Parts 3.2.2.1.2 and 3.2.2.1.3, feasibility and cost may need to be taken into account. In addition to options presented here, MPI will welcome any alternative suggestions on how risk associated with bacteria, fungi and oomycetes could be managed in a way that will provide a level of protection consistent with that for other regulated pests.

(73) It is very important to note that the level of protection established for *Prunus* plants for planting is likely to be applied when MPI reviews import requirements for other genera of plants for planting that have a similar risk profile to *Prunus* (for example including other high value crop species). As

such, MPI is seeking feedback on this matter from all interested stakeholder groups, and not just those directly affected by the proposal for *Prunus* plants for planting.

3.2.2.1.1 Option 1: Maintaining the status quo

(74) Since the existing *Prunus* import schedule was issued in 2004, risk associated with bacteria, fungi and oomycetes has been managed predominantly by a requirement for plants to be regularly inspected throughout the post entry quarantine period in New Zealand.

a) Under the existing standard, all plants must be inspected for signs of pests and disease by the operator of the post entry quarantine facility at least twice per week during periods of active growth and once per week during dormancy. Plants are also inspected a minimum of five times by an MPI inspector over the duration of the quarantine period. Whilst in quarantine, *Prunus* plants for planting imported into New Zealand are generally contained in greenhouses with limited climate control, and plants are maintained under conditions considered optimal for plant growth;

b) Three particularly high risk pests of *Prunus* (i.e. *Ceratocystis* spp., *Phytophthora ramorum* and *X. fastidiosa*) also require testing by PCR and/or plating of samples on suitable isolation medium. Additional measures for *Ceratocystis* spp. and *P. ramorum* were introduced within the last five years, with reliance on growing season inspection before that. Testing requirements for *X. fastidiosa* have been in place since the standard was issued in 2004;

c) The existing standard also requires asymptomatic leaf samples from each imported plant to be plated on potato dextrose agar to help manage risk from regulated fungi. Culture-based detection using leaf samples taken from healthy plants is now considered unlikely to be an effective detection technique. This method is not proposed as a risk management measure in the revised standard, for the following reasons:

i. Culturing using a generic culture medium (such as potato dextrose agar) may reveal the presence of a particular organism, or class of organism within an asymptomatic plant. However, this does not provide any information about whether that organism is pathogenic towards a particular host species;

ii. Culturing generally has low specificity and sensitivity and can produce inconclusive results:

- When culturing samples taken from asymptomatic plants in post entry quarantine, staff at the MPI Plant Health and Environment Laboratory (PHEL) have mainly isolated endophytic or saprophytic organisms. These organisms are ubiquitous, relatively unstudied and extremely diverse, often meaning that it is not possible to identify to the species level;
- These ubiquitous types of organism would not meet the definition of a quarantine pest as defined under ISPM 5: *Glossary of phytosanitary terms*. As such, when used for mandatory testing on asymptomatic samples, culturing is now seen as being of very limited value when making regulatory decisions;
- Culturing will not effectively detect regulated pests that are un-culturable and/or very slow growing, or that are not suited to growing on generic culture media.

iii. Culturing leaf samples will not detect regulated pests growing in woody parts of the plant, and vice versa;

iv. False negative results will be obtained if regulated fungi or oomycetes are unevenly distributed throughout the plant and are not contained within the sample selected for testing (as is the case with any diagnostic test).

(75) There are no known instances of any regulated pests being introduced to New Zealand in *Prunus* plants imported according to the requirements of the existing standard, and no records of any major bacterial, fungal or oomycete regulated pests being detected on *Prunus* plants in quarantine in New Zealand.

a) As noted in paragraph (26), all imported *Prunus* plants for planting over the past ten years have been from MPI-accredited sources. Plants obtained from approved sources are grown in screenhouses at the pre-export production site and are regularly inspected for signs of disease prior to export. Fungicide treatments are applied if symptoms of fungal disease are identified and/or as part of a regular fungicide spray programme (depending on the particular production facility). Aside from that, specific measures are not generally applied to manage risk from regulated fungi prior to export. Some offshore facilities explicitly state that plants they produce are not guaranteed to be free of fungi (or other pests).

(76) Based on the above information, existing risk management measures may be seen as being appropriate to manage risk on this pathway, particularly for *Prunus* sourced from MPI-approved offshore facilities, given the long history of trade and compliant consignments.

a) It is noted that using growing season inspection as the sole method to manage risk from most bacteria, fungi and oomycetes is not as sensitive as methods used to detect other regulated pests of *Prunus* that may have a similar adverse impact on plant health. Likewise, this method is less sensitive than techniques proposed to detect regulated pests with a similar risk profile on other plant genera (such as *Actinidia*), as described in the following section).

3.2.2.1.2 Option 2: Applying specific environmental conditions in post entry quarantine

(77) MPI has recently proposed new measures, focussed on growing plants under conditions known to be conducive to disease development, to better manage risk from various classes of regulated pest including bacteria, fungi, oomycetes and viroids that may otherwise be difficult to detect. These measures were proposed for both *Actinidia* (as per the import health standard published in 2018)and *Citrus* (measures proposed in 2016, but not yet adopted[2]). As discussed in the following sections, this option will provide a higher level of protection than existing measures, but is likely to result in more cost to importers and may take some time to implement.

a) Growing plants under conditions conducive to disease development is listed as a general requirement that may be considered for post entry quarantine facilities in ISPM 34: *Design and operation of post-entry quarantine stations for plants*, and is recognised as a risk management measure in ISPM 36: *Integrated measures for plants for planting*;

b) This measure was recommended for further investigation in a report to the Germplasm Advisory Committee (Germac) in 2011, as summarised by Johnson (2014)[3], to increase the possibility of detecting regulated pests that may be present on imported plant material and to further reduce overall biosecurity risk;

c) In 2018 MPI proposed growing *Actinidia* plants for planting[4] under conditions conducive to disease development to help manage biosecurity risk from certain classes of regulated pest including high risk bacteria, fungi and oomycetes. This included regulated pests such as

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[2] [2] Risk management proposal for *Citrus* nursery stock available at https://www.mpi.govt.nz/dmsdocument/14137-risk-management-proposal-import-health-standard-ihs-155-02-06-importation-of-nursery-stock-schedule-of-special-conditions-for-citrus-including-citrus-fortunella-and-poncirus-from-all-countries-draft-for-consultation. This import health standard has not yet been re-issued.

[3] Johnson, N. (2014). Barriers to importation of plant germplasm. https://www.mpi.govt.nz/dmsdocument/6949-barriers-to-importation-of-plant-germplasm.

[4] Import health standard for *Actinidia* plants for planting available at https://www.biosecurity.govt.nz/document-vault/29894.

Pseudomonas syringae pv. *actinidiae* (Psa), *Ceratocystis fimbriata* and *Phytophthora* spp. The measures include growing plants at 21°C to 25°C and 25°C to 30°C with high humidity (70-80%), because these conditions are known to be conducive to development and/or symptom expression of multiple regulated pests, including those listed above. Likewise, under the proposed new import health standard for *Citrus* plants for planting[5], that has not yet been issued, imported *Citrus* plants must be grown at 18°C to 25°C for 5 months and 28°C to 32°C for 3 months, to increase the likelihood of detecting various *Liberibacter* and viroid species.

(78) Growing plants under conditions conducive to disease development is likely to provide a higher level of protection for various species of regulated bacteria, fungi and oomycetes on *Prunus* plants for planting because:

a) Symptoms are more likely to become visible on plants that are infected with regulated pests when plants are grown under conditions suitable for disease development:

i. Disease development usually occurs when environmental conditions favour development of the pathogen (for example as discussed in Agrios, 2005[6] and Moore et al., 2011[7]);

ii. Disease symptoms are much less likely to develop when conditions are optimal for plant growth[6,7];

iii. Conditions known to be conducive for disease development for certain regulated bacteria, fungi and oomycetes on *Prunus* plants for planting are identified in Parts 4.3.1 and 4.3.2 of this document.

b) Even if symptoms do not become visible, growing plants under conditions conducive to disease development is likely to increase the pathogen titre and hence increase the likelihood of detection by other methods (for example when using PCR to detect pathogens that require mandatory testing);

c) Growing plants under conditions that are known to be conducive to development of a wide range of pathogens is more likely to result in symptom expression from any unknown or emerging regulated pests for which specific diagnostic tests are not available. As such, there will be more effective management of unknown risk.

(79) Examples of high impact regulated pests associated with *Prunus* plants for planting that are likely to be more effectively managed by growing plants under defined environmental conditions include *Phytophthora* spp., *Spiroplasma citri*, and *X. fastidiosa*. Other regulated pests are also considered more likely to display symptoms under such conditions, as noted in Parts 4.3.1 and 4.3.2 of this document. This approach is also considered more likely to result in the detection of regulated pests of *Prunus* that are not specifically identified in the standard, and for which the only required risk management measure is plant health inspections throughout the quarantine period.

(80) The approach described above would represent a change in the level of protection from certain species of bacteria, fungi and oomycetes associated with *Prunus* plants for planting. This will more closely align the level of protection for these types of organism with that for other pests regulated by MPI, including those with a high impact (for example including phytoplasmas and various species of viroid and virus).

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[5] Risk management proposal for *Citrus* nursery stock available at https://www.mpi.govt.nz/dmsdocument/14137-risk-management-proposal-import-health-standard-ihs-155-02-06-importation-of-nursery-stock-schedule-of-special-conditions-for-citrus-including-citrus-fortunella-and-poncirus-from-all-countries-draft-for-consultation. This import health standard has not yet been re-issued.

[6] Agrios, G.N., 2005. Plant Pathology. 5th eds. Department of Plant Pathology. University of Florida. United States of America.

[7] Moore, D., Robson, G.D. & Trinci, A.P.J. (2011). *21st Century Guidebook to Fungi.* Cambridge, UK: Cambridge University Press.

a) A similar level of protection should be required for different classes of regulated pest that are likely to have a similar environmental and/or economic impact, where this is feasible;

b) Different plant genera may have a similar risk profile, and may be infected by the same regulated pests, or genera of regulated pests. In such cases, a similar level of protection should be provided across different genera of plants for planting. The approach described above will help to ensure that this is the case because:

   i. The proposed screening is consistent with measures recently consulted on for the new import health standard for *Actinidia* plants for planting to manage risk from various bacteria, fungi, oomycetes and viruses;

   ii. The proposed screening is similar to measures proposed in 2016 (but not yet adopted) to manage risk from temperature sensitive bacteria on *Citrus* plants for planting;

   iii. The proposed screening is more consistent with existing requirements for detecting regulated phytoplasmas, viroids and viruses on high value crops, where samples for PCR testing must be collected when plants have been grown under seasonal conditions known to be optimal for pathogen development.

(81) The level of risk from regulated bacteria, fungi and oomycetes on the plants for planting pathway has not necessarily changed since the *Prunus*, and other nursery stock import schedules, were originally issued. However, there is now recognition that measures applied prior to export, and in post entry quarantine in New Zealand, may not give the desired level of protection for this commodity type. This proposed approach takes into account the greater recognition, by industry and government organisations, of the threat posed by regulated pests such as the *Ceratocystis* and *Phytophthora* genera (both of which are associated with *Prunus* plants for planting), and regulated pests in general, since the *Prunus* schedule last underwent significant revision (in 2004).

(82) MPI recognises that there may be operational implications if such measures are applied in post entry quarantine, as discussed below:

a) The proposed conditions may encourage the growth of non-regulated pests, either of local origin or introduced in association with the imported plants. This may result in increased costs, for example if these organisms need to be identified by a diagnostic facility and/or if treatments must be applied to symptomatic plants. However:

   i. When plants are contained in a Level 3B post entry quarantine greenhouse, contamination with local origin organisms in the first growing season will be minimised because all incoming air must be filtered through fine dust filters (which will exclude most, or all, disease propagules);

   ii. MPI has discussed possible impacts of the proposed measures on plant health with staff who operate the Australian government post entry quarantine greenhouse. Similar environmental conditions are required for plant genera including *Actinidia* and *Prunus* imported into Australia, where plants must be grown at high humidity for at least six weeks (for example at temperatures between 19°C to 25°C) on arrival at the facility. These conditions have not caused any significant increase in symptoms from non-regulated pests, or had a significant adverse impact on plant health on plants at the Australian Mickleham facility. However, this facility has been constructed in a way that will minimise adverse effects on plant health (e.g. by having high ceilings and high air exchange rates). This may not be the case in an existing greenhouse that was not designed with a view to applying such environmental conditions.

b) While it remains possible that the environmental requirements may have some adverse effect on plant health, growing plants under conditions conducive to regulated pest development will be an important measure to help ensure that imported germplasm is free

from regulated pests. This is particularly important when growing season inspection is the sole method used to screen for disease, given that symptoms may not develop when plants are grown under conditions optimal for plant growth;

c) Although there may be increased costs associated with applying such conditions, if the requirement for mandatory testing by plating leaf samples on agar is removed, this will remove some costs associated with importing plants under the existing *Prunus* standard. These testing costs can be considerable if fungi are isolated that require DNA sequence analysis to identify them;

d) Because the environmental conditions may not be optimal for plant growth, an extra period of growth may be needed during the first growing season to develop plants to a stage where this treatment will not have an unacceptable adverse effect on plant health, or to allow resumption of growth after the conditions have been applied;

e) It is noted that additional plants, derived from plants that will be exposed to the specified environmental conditions, can be multiplied during the quarantine period. These plants would not need to be grown under the conditions specified in the draft standard. As such, if desired by the importer, imported material can be grown under conditions optimal for plant growth whilst the parental material is being screened for disease. These plants would need to be held in the same type of post entry quarantine facility as the parental material, and would become eligible for biosecurity clearance at the same time as parental plants. It is noted that there may be barriers, or higher costs to taking this approach, if additional quarantine greenhouse space is needed;

f) Additional equipment (e.g. fogging systems) may be needed to effectively maintain high humidity and temperature regimes in existing greenhouses. There is a greater load on heating systems at high humidity (because increasing humidity has a cooling effect). This means that existing HVAC systems may struggle to maintain the proposed conditions, and more significant changes may need to be made to facility infrastructure to reliably apply such conditions to plants in post entry quarantine on an ongoing basis.

(83) Based on the above information, under this risk management option, a prolonged lead in time may be needed to allow facilities to implement the new requirements. If introduced with immediate effect this would present a barrier to import because, based on conversations with staff from post entry quarantine facilities in New Zealand, MPI is not aware of any existing facilities who would be able to apply the proposed high humidity regime without making changes to the facility structure. There may be considerable capital costs to upgrade existing facilities to a level where they could reliably apply the proposed conditions. Given the long term nature of bookings at post entry quarantine facilities, sufficient time will also need to be given to allow facilities to implement such changes without significantly impacting day-to-day operations.

(84) Taking into account the above information it is suggested that if this proposal is adopted there should be a staged implementation. As an interim option, imported *Prunus* plants for planting could be held at the required temperature ranges from the time the import health standard takes effect, but the proposed humidity requirements could become mandatory at a later date.

a) Holding plants at the required temperature ranges is likely to result in more effective management of some high risk regulated pests (for example including *S. citri* and *X. fastidiosa*). There are some existing post entry quarantine facilities that would be able to apply these conditions without any need for facility modification;

b) Because of the potential significant costs and logistical implications associated with upgrading a facility it is proposed that under this option, a three year lead-in time should be given before compliance with the proposed humidity regimes is mandatory. This is considered appropriate in the case of *Prunus* plants for planting given the long history of trade under existing import conditions.

3.2.2.1.3 Option 3: Maintaining the status quo, with more comprehensive testing requirements and no requirement for plating on agar

(85) In addition to growing season inspection as required under the existing standard (i.e. without manipulating environmental conditions), additional PCR testing could be done to provide further assurance that certain regulated pests are not present in imported plants. This could apply to particularly high risk regulated pests, as well as regulated pests where there is evidence that symptoms may not develop unless plants are exposed to specific climatic conditions.

(86) Relying solely on PCR testing of asymptomatic material taken from plants growing in post entry quarantine may not effectively manage risk from all bacteria, fungi and oomycetes because:

a) It may not be possible to collect representative samples for testing, especially when asymptomatic plants are tested. This is because pests such as fungi and oomycetes may have a restricted distribution within an infected plant. False negative results will be obtained if pests are unevenly distributed throughout the plant and not contained within the sample(s) selected for testing;

b) Although PCR can be highly sensitive and specific, and is likely to be more sensitive and specific than culturing, it still relies on the target pest being present in the sample selected for testing, and at levels high enough to be reliably detected;

c) This is in contrast to when PCR is used to test for organisms such as phytoplasmas and viruses that are likely to be systemically distributed throughout a plant, or where there is specific epidemiological information about sampling strategies that can be used to provide a very high degree of certainty that a particular pest is absent. This is precisely why greater reliance is placed on growing season inspections for detecting fungi and oomycetes than for detecting some other classes of organism;

d) Given the large number of regulated fungi associated with *Prunus* plants for planting, it would not be possible to test plants growing in post entry quarantine for all regulated species. As such, there will still be reliance on growing season inspection to manage risk from many species.

(87) To increase the likelihood of detecting some regulated pests, in addition to testing samples from plants growing in post entry quarantine, destructive sampling and PCR testing could be done using the originally imported budsticks (which are discarded after buds are grafted onto rootstocks in post entry quarantine).

a) Destructively testing the originally imported stem material (once buds have been grafted onto local origin rootstocks) may allow for more representative sampling of imported material. This could help give greater certainty of freedom from targeted regulated pests;

i. The testing would be used to provide greater certainty that regulated pests that may have an uneven distribution, and that may be difficult to reliably detect in asymptomatic samples, are not present in imported material. Additional destructive testing would not be used to test for regulated pests that are likely to be systemic and/or reliably detected using samples taken from plants growing in post entry quarantine.

ii. It would not be feasible to do PCR testing for all regulated pests that may be present on *Prunus* plants for planting, in particular given the large number of regulated fungi that may be associated with this commodity. This measure would need to be targeted at particularly high risk pests, and/or other regulated pests where there is evidence that growing season inspection in post entry quarantine may not be reliable. Growing season inspection, as required under the existing import health standard (discussed in Part 3.2.2.1.1), would still be used to manage risk from regulated pests with no requirement for specific testing;

iii. This type of testing would be only useful for detecting wood-inhabiting regulated pests (for example including *Ceratocystis* spp. and *Phytophthora* spp.). Regulated pests such as bacteria, that tend to be located in bud tissue, would not reliably be detected using this approach.

b) Validated PCR diagnostic tests may not be available for all regulated pests for which testing is needed under this option. Hence a lead in time may be necessary to allow tests to be developed, and funding and resources would need to be provided to develop the tests.

(88) As well as needing to develop new tests, sampling methods will need reviewing to ensure the maximised likelihood of detecting target regulated pests if they are present in imported plants. The most suitable tissue type and sampling regime should be decided for each regulated pest for which testing is needed.

(89) If this option is chosen, in order to allow ongoing trade, there will need to be a staged implementation with additional tests added as they become available. Introduction of additional tests will depend on resource being set aside to prioritise developing these tests. As such, there may be a considerable delay before all necessary tests could be introduced.

4. Proposed risk management measures for *Prunus* plants for planting

(90) This section of the risk management proposal includes the following:

a) A description of the proposed requirements for screening for regulated pests;

b) A description of the proposed requirements for post entry quarantine including the length of the quarantine period and the level of post entry quarantine greenhouse required for *Prunus* plants for planting;

c) A summary of all regulated pests for which specific phytosanitary measures are proposed, and a description of the disease screening measure(s) that are proposed for each pest.

(91) All phytosanitary measures described in this section must be applied in New Zealand unless plants are produced under an Export Plan or at an Offshore Facility. Plants that are produced using one of these options will have fewer requirements on arrival in New Zealand because some, or all of the required measures will have been applied prior to export.

(92) For each consignment of *Prunus* plants for planting, the phytosanitary measures that need to be applied in New Zealand will be identified on the import permit, as discussed in Part 5.1 of this risk management proposal.

4.1 Proposed requirements for screening for regulated pests

(93) All *Prunus* plants for planting will be screened for regulated pests as described in Part 2.3 of the draft standard. Proposed screening will consist of a combination of some or all of the following measures, depending on the characteristics of the regulated pest:

a) Regular plant health inspections to detect any signs or symptoms of regulated pests;

b) Exposing plants to specific environmental conditions conducive to disease development;

c) Specific testing (for example using polymerase chain reaction (PCR) or culture based identification for the targeted detection of specified regulated pests).

4.1.1 Environmental conditions

(94) Taking into account information in part 3.2.2.1 of this risk management proposal, and based on information about specific regulated pests in Part 4.3, it is proposed that *Prunus* plants imported into New Zealand should be exposed to specific environmental conditions that will increase the likelihood of detecting regulated pests either directly (by inducing expression of visible disease symptoms), or indirectly (by increasing the titre of an organism before samples are taken for pre-determined testing).

a) As noted in paragraph (72) MPI is seeking specific feedback on risk management options for bacteria, fungi and oomycetes. Based on existing information, the option which MPI considers will provide a level of protection consistent with the level achieved for other classes of regulated pest (i.e. the highest level of protection) is proposed for inclusion in the standard. However, the MPI Chief Technical Officer (CTO) will consider all information provided in submissions before finalising risk management requirements for these regulated pests. This means that measures in the final draft standard may differ to those proposed below;

b) Proposed conditions, described in the following sections, are included in part 2.3.1 of the draft standard;

c) MPI recognises that it may not be operationally feasible for any existing post entry quarantine facilities to apply all conditions identified below with immediate effect. In particular this applies to growing plants under high humidity, which may be difficult to do if facilities were not built with this purpose in mind. Because of this it is proposed that an implementation period should apply. The implementation period will apply only to the requirement for plants to be held at high relative humidity; all other conditions described below will be expected to be applied from the date the standard is issued. As discussed elsewhere in this risk management proposal, an implementation period of three years is proposed.

(95) Post entry quarantine facility operators will be required to describe how the proposed conditions will be applied in the operating manual for each facility, and to maintain records demonstrating compliance with the conditions described in the standard.

4.1.1.1 Spring-like conditions for three or four months

(96) At the start of the first growing season[8], plants must be held for four months at a daytime temperature range between 18°C and 21°C and night time temperatures below 18°C. At the start of the second growing season, plants must be held under these conditions for a minimum of three months.

(97) This temperature range is generally considered conducive to the detection of viral diseases (either directly when symptoms are expressed, or indirectly by testing using PCR or herbaceous indicator plants; see Part 4.3.4), given that spring is the optimal time for viral replication.

(98) The four month period under spring-like conditions at the start of the first growing season will be long enough to ensure that there is sufficient plant growth to enable the first batch of samples to be taken for mandatory testing (see Part 4.1.3). This is reduced to three months in the second growing season because this is considered long enough for sufficient quantities of leaf material to become available for mandatory testing.

4.1.1.2 Summer-like conditions for four months

(99) Following the spring-like conditions, plants must be held for four months at a daytime temperature range between 21°C and 25°C and night time temperatures above 18°C (except when plants are being held as described in paragraph (100)).

a) These conditions are expected to be broadly conducive to symptom development of certain fungal, oomycete and bacterial diseases. As discussed in paragraph (74), it is proposed that this requirement will replace the existing requirement for leaf samples to be plated on potato dextrose agar (to detect regulated fungi). Summer-like conditions will also provide conditions suitable for maximising the likelihood of detecting phytoplasmas and viroids.

(100) During the summer-like period in the first growing season, it is proposed that plants should be exposed to the following additional environmental conditions:

a) A continuous 28 day period at a minimum relative humidity of 75% (±5%) (whilst day and night time temperatures are maintained at 21°C to 25°C);

b) High humidity in conjunction with the above temperatures will encourage the expression of foliar symptoms of fungal infection (for example including some of the species identified in Part 4.3.2 of this risk management proposal).

[8] For the purpose of this risk management proposal, a "growing season" is defined as the period during which plants are exposed to spring-summer- and autumn-like conditions.

(101) A continuous 28 day period with a daytime temperature range between of 25°C and 30°C, and night time temperatures above 20°C. Plants must continue to be held at a minimum relative humidity of 75% (±5%) during this time:

a) These conditions are likely to be conducive to symptom expression and/or growth of regulated pests such as *Ceratocystis* and *Phytophthora spp.* (see part 4.3.2) and regulated bacteria including *S. citri* and *X. fastidiosa* (see Part 4.3.1);

b) This regime must be applied after plants have been exposed to conditions described in paragraph (100);

(102) The environmental conditions described in paragraphs (100) and (101) can be applied at any time during the summer growth period, with consideration given to how plants will best acclimatise and adapt physiologically to these conditions.

(103) The high humidity conditions described in paragraphs (100) and (101) are only required in the first growing season. The proposed temperature regimes will be required in both seasons.

4.1.1.3 Autumn-like conditions for two months

(104) Plants must be held for two months at a temperature range between 15°C and 18°C for the autumn-like period of each growing season although lower temperatures may be applied at night time.

(105) It is considered important for plant health to expose plants to autumn-like temperatures prior to transitioning into dormancy to mimic the natural seasonal cycle. Growing season inspections will also be required in autumn to identify any regulated pests that may induce symptoms under these conditions.

4.1.1.4 Dormancy for two months

(106) Plants must be held dormant for two months at the end of the first growing season to ensure that there is a clear separation between seasons, and to mimic the natural seasonal cycle.

(107) During dormancy it is expected that plants will be held at temperatures that will provide sufficient chilling hours for leaves and buds to develop normally in the spring of the following growing season. If necessary, plants can be transferred to a cool room that is part of the quarantine facility in order to reliably apply the required temperatures. For the types of *Prunus* plants for planting imported into New Zealand, it is understood that temperatures between 2°C and 7°C will generally achieve this purpose.

(108) Temperatures that will be applied during dormancy must be described in the facility operating manual and approved by MPI before use.

4.1.2 Plant health inspections

(109) All plants must be regularly inspected throughout the quarantine period, as described in Part 2.3.3 of the draft standard, to detect any disease symptoms, and identify any regulated pests, as soon as possible.

4.1.2.1 Inspections by the post entry quarantine facility operator (or nominated delegate)

(110) The facility operator (or a nominated delegate) must inspect all plants for signs and symptoms of pests and diseases two times per week for the duration of the quarantine period:

a) As stated in the post entry quarantine facility standard, if plants are bagged and held in cool storage for dormancy, inspections are not required during this time;

b) It is a requirement of the post entry quarantine facility standard that accurate records must be kept of all inspections;

c) The facility standard also describes actions that must be taken following the detection of a pest or disease in post entry quarantine.

(111) Information about inspections by the operator is given in parts 3.6.1 of both the MPI Facility Standard: Post Entry Quarantine for Plants and the Guidance Document: Post Entry Quarantine for Plants. Part 3.7 of these documents includes information about reporting timeframes and actions to be taken by the facility operator if a disease organism is detected in post entry quarantine.

4.1.2.2 Inspections by the MPI inspector

(112) The MPI inspector must inspect all plants in the post entry quarantine greenhouse for signs and symptoms of regulated pests and disease at regular intervals throughout the quarantine period.

(113) A total of ten inspections will be done by the inspector (five in each growing season):

a) During the first growing season, inspections should be completed as follows:

i. Inspection 1: within 14-28 days of all plants entering a state of active growth in the Level 3B greenhouse;

ii. Inspection 2: during the final 14 days of the four month period of spring like growth in the first growing season;

iii. Inspection 3: when plants are being grown between 21°C and 25°C with relative minimum relative humidity of 75% (±5%);

iv. Inspection 4: either during the final seven days of the 28 day period at 25°C to 30°C, or in the seven days immediately following the completion of this period;

v. Inspection 5: during the final 28 days of growth under autumn-like conditions.

b) Inspections will be done at similar times in the second growing season.

(114) Information about inspections by the MPI inspector is given in part 3.6.2 of the MPI Facility Standard: Post Entry Quarantine for Plants and the Guidance Document: Post Entry Quarantine for Plants.

4.1.3 Testing for regulated pests

(115) All plants will require testing to verify freedom from regulated pests as follows:

a) Diagnostic testing:

i. Diagnostic testing may be undertaken when disease symptoms become evident on a plant in post entry quarantine to verify the regulatory status of the organism causing the symptoms;

ii. Depending on the type of symptoms, samples may be tested for the presence of various classes of disease organism, including bacteria, fungi, oomycetes, phytoplasmas, viroids and viruses;

iii. The exact diagnostic test(s) that will be done will be decided on by the MPI inspector, and by staff at the diagnostic facility. This will depend on the type of disease symptom(s) that are present.

b) Mandatory testing:

i. Mandatory testing is targeted testing that must be done for specified regulated pests (identified in Schedules 1 and 2 of the draft standard), regardless of whether or not the plant is showing signs or symptoms of pests or disease;

ii. Mandatory testing is required to provide additional assurance that a consignment is free from particularly high risk regulated pests, and/or if it is recognised that growing season inspection may not effectively manage the risk (e.g. when it is known that a particular regulated pest has a prolonged latent period, meaning that infected plants may not show symptoms in post entry quarantine).

iii. Sampling times, and the type of tests required are given in Schedules 1 and 2 of the draft standard.

(116) All testing must be done in a diagnostic facility accredited to the MPI Standard 155.04.03: A standard for diagnostic facilities which undertake the identification of new organisms, excluding animal pathogens.

4.2 Proposed requirements for post entry quarantine

(117) On arrival in New Zealand, all *Prunus* plants for planting will require post entry quarantine in a greenhouse accredited to the MPI Facility Standard: Post Entry Quarantine for Plants, as described in Part 2.4 of the draft standard. The purpose of this is to ensure that any regulated pests that are imported in association with *Prunus* plants for planting do not escape into the wider environment whilst plants are being screened for these pests.

a) The facility standard sets the operational and structural requirements for post entry quarantine facilities;

b) All facilities are regularly audited by MPI to ensure ongoing compliance with all relevant standards.

(118) The quarantine period and level of post entry quarantine are discussed in the following sections.

4.2.1 Quarantine period

(119) *Prunus* plants for planting will require 21 months post entry quarantine before they can become eligible for a biosecurity clearance (this requirement may differ when plants are produced under an *Export Plan* or obtained from an *Offshore Facility*, as discussed in Parts 3.2.1 and 5.2 of this risk management proposal).

a) This is the minimum amount of time that will be needed to screen plants for regulated pests;

b) During this time the plants will have two complete growing seasons, and one period of dormancy in between the first and second growing seasons;

c) Factors that were considered when determining the length of the quarantine period are discussed below.

(120) The quarantine period must be long enough to ensure that, when combined with other risk management measures, risk will be appropriately managed before a biosecurity clearance is issued.

a) The two growing season period combined with applying defined environmental conditions and doing mandatory testing for specified regulated pests is intended to maximise the likelihood of detecting pests identified in the draft standard, and hence minimise biosecurity risk associated with these pests;

b) Mandatory testing over two growing seasons is considered necessary to manage risk from certain high risk pests, as identified in Part 4.3 of this risk management proposal;

c) As well as managing known risk, post entry quarantine is an important measure by which new risk organisms or new host associations are identified on the plants for planting pathway. There are multiple examples of new host associations being identified in plants in post entry quarantine in New Zealand. This highlights the need for plants to be grown under conditions known to be broadly conducive to disease symptom expression, and for the quarantine period to be long enough to allow organisms which may be at very low concentrations, and for which specific testing is not required, to build up sufficiently to induce symptoms. Two growing seasons is considered an appropriate amount of time to achieve this goal.

(121) The proposed quarantine period is shorter than the previous requirement (which was for all *Prunus* plants to be in a state of active growth for a minimum 24 month period). The combination of measures proposed in the draft standard is considered likely to manage risk at least as effectively as previous requirements, and is consistent with the level of protection previously established for high value plants for planting, including as part of the recent public consultation on risk management measures for *Actinidia* plants for planting (in 2018).

(122) MPI accept that there is a high level of uncertainty to consider when setting a post entry quarantine period. The proposed quarantine period of 21 months is intended to provide a high likelihood of detecting any regulated pests that are present in imported plants for planting, while at the same time being a balanced approach in terms of not imposing overly restrictive quarantine requirements.

4.2.2 Level of post entry quarantine

(123) The level of post entry quarantine is determined by the pests of concern identified for any given plant genus, and the specific containment features required to contain these pests.

a) For *Prunus* plants for planting from non-approved sources, it is proposed that plants should be held in a Level 3B quarantine greenhouse for disease screening in the first growing season. In the second growing season, the importer may elect to transfer plants to a Level 3A greenhouse for the remainder of the quarantine period. If transferred to a Level 3A greenhouse, this can be done at the time plants enter dormancy, after all leaves have dropped;

b) For *Prunus* plants for planting from offshore facilities (or obtained under an Export Plan), Part 5.2, paragraph (185), explains that if material from an approved source needs residual screening on arrival in New Zealand, this will likely require quarantine in a Level 3A greenhouse, not a Level 3B greenhouse.

4.2.2.1 Level 3B post entry quarantine greenhouse

(124) A Level 3B post entry quarantine greenhouse is the most secure level of quarantine facility under the MPI Facility Standard: Post Entry Quarantine for Plants. This level of facility can provide containment of highly mobile spore-dispersed organisms, as well as mite-vectored organisms, which is considered particularly important in the first growing season. This is because plants will be of an unknown phytosanitary status (aside from being visually inspected by the NPPO of the exporting country prior to export) and will be exposed to environmental conditions in post entry quarantine that may be conducive to the production of dispersal structures such as windborne spores.

(125) In particular, the first growing season will be used to verify freedom from the highest risk regulated pests (such as *Phytophthora* spp., phytoplasmas, *Plum pox virus* and X. *fastidiosa*). These types of organism require containment in a Level 3B greenhouse because of their means of dispersal, and/or because of their potential high impact.

4.2.2.2 Level 3A post entry quarantine greenhouse

(126) Quarantine in a Level 3A greenhouse for the second growing season (and for the period of dormancy between the first and second seasons) is considered to correspond with the level of residual risk associated with *Prunus* plants for planting for the following reasons:

a) Screening for highly mobile and particularly high risk regulated pests, along with mandatory testing for other regulated pests, will have been done in the first growing season, so the plants will no longer be of unknown phytosanitary status;

b) Plants will have been regularly inspected for disease symptoms over the previous ten months, with remedial action (e.g. treatment) taken if any regulated pests are identified;

c) Risk associated with water-borne regulated pests will be effectively managed in a Level 3A greenhouse given the requirement for all waste water to be treated before exiting the facility.

(127) Although risk will be lower in the second growing season, it is recognised that sporulating organisms (which may not be contained within a Level 3A greenhouse based solely on the physical requirements for this level of facility) could still be present in the imported plants. However, the following operational measures are considered sufficient to manage this risk during the second season:

a) Regular plant health inspections (twice per week) must be completed by the post entry quarantine facility operator in order to detect any disease symptoms as soon as practical;

b) Contingency plans must be developed to describe actions that will be taken to contain any spore-borne disease organisms within the facility in the event that disease symptoms are observed;

c) Operational restrictions must be applied to minimise the likelihood of spores being dispersed outside the PEQ facility. In particular, overhead irrigation will be prohibited; this will minimise the chances of fungi which are aerially dispersed (e.g. by rain splash) from escaping from the facility.

(128) Level 3A post entry quarantine greenhouses must be fitted with a heating and cooling system that has sufficient capacity to maintain relevant environmental conditions throughout the growing season.

(129) If a request is made to transfer plants to a Level 3A greenhouse in the second growing season, this will only be allowed if:

a) All environmental conditions were applied as required in the first growing season;

b) All mandatory testing was completed during the first growing season;

c) Remedial actions were taken to manage the risk associated with any regulated pests that were detected in the first growing season, including verification that any remedial actions were effective.

4.3 Summary of regulated pests

(130) This part of the risk management proposal summarises regulated pests of *Prunus* plants for planting which require specific phytosanitary measures to be applied in post entry quarantine.

(131) Pests identified in this section are those which the MPI risk analysis concluded should be regarded as regulated. Information about entry, establishment and impact is included in the risk analysis, but not repeated here.

(132) Growing season inspection throughout the quarantine period is a general requirement that must be applied to help manage risk from all regulated pests that may be associated with plants for planting imported into New Zealand. This may be considered sufficient to appropriately manage

risk from some regulated pests, for example where there is evidence where disease symptoms will be expressed in the post entry quarantine greenhouse, or where pests are likely to have a limited impact. For other pests, where there is greater risk and/or evidence that symptoms will not be seen in quarantine, additional measures (for example specific testing using PCR) may be required. The combination of measures proposed to manage each regulated pest are identified in this section.

4.3.1 Bacteria

(133) The MPI hazard identification recognised seven species or pathovars of bacteria as regulated pests on *Prunus* plants for planting:

a) *Pseudomonas amygdali*, *Pseudomonas cerasi, Pseudomonas syringae* pv. *avii*, *Pseudomonas syringae* pv. *cerasicola* and *Xanthomonas prunicola*. All of these species are expected be detected during growing season inspection over the proposed 21 month period of post entry quarantine under environmental conditions described in Part 4.1.1. As such, risk management measures other than growing season inspection are not considered necessary for these species, for the following reasons:

i. Visible symptoms of infection with *P. amygdali* on *Prunus dulcis* (almond) are expressed in the spring following infection (which generally occurs in autumn).

- Imported plants will undergo two periods of growth under spring-like conditions during the 21 month period of post entry quarantine;
- No records were found of *P. amygdali* causing asymptomatic infections;
- No reports were found of *P. amygdali* affecting any *Prunus* spp. other than *P. dulcis*.

ii. There is no specific information about how long it would take for symptoms of infection with *P. cerasi* (first identified in 2016) to become visible. However, this species is likely to display similar characteristics to other members of the genus, including those assessed here;

iii. Visible symptoms of infection with *P. syringae* pv. *cerasicola* became evident between two weeks and 90 days after inoculation of actively growing *Prunus* spp., depending on the host species.

- After inoculation, plants were held at temperatures between about 20°C and 30°C;
- Plants will be held within this temperature range during the summer-like conditions in post entry quarantine.

iv. Visible symptoms of infection with *P. syringae* pv. *avii* became visible within months of experimental inoculation of plants;

v. Visible signs of infection with *X. prunicola* became visible within five days after artificial inoculation on plants held at 30°C with a 16 hour photoperiod.

b) *Spiroplasma citri* and *Xylella fastidiosa*. Both of these species were identified as requiring specific phytosanitary measures in post entry quarantine, in addition to growing season inspection, as discussed below.

4.3.1.1 *Spiroplasma citri*

(134) Specific phytosanitary measures in post entry quarantine, namely testing using PCR, are justified and sufficient to manage the risk from *S. citri* on *Prunus* plants for planting for the following reasons:

a) *S. citri* has the potential to cause economic impacts if introduced into New Zealand[9].

   i. *S. citri* causes stubborn disease of citrus, a high impact disease which can be a significant restraint on citrus production. The domestic value of the New Zealand citrus industry was $61 million in 2017;

   ii. *S. citri* also causes disease on other hosts, including purple leaf of carrot.

b) *S. citri* may not be detected by visual inspection of *Prunus* plants for planting.

   i. There are reports that *S. citri* is associated with *Prunus* spp. that do not display any symptoms of infection.

c) *S. citri* is likely to be able to establish in New Zealand.

   i. Known host plants are present in New Zealand;

   ii. The New Zealand climate is likely to be suitable for establishment;

   iii. The bacterium may be spread by the propagation of infected planting material.

d) There is the potential for S*. citri* to be transmitted to other plant hosts if it were to arrive in New Zealand.

   i. *S. citri* is transmitted by phloem feeding leaf hoppers in the genera *Circulifer, Scaphytopius* and *Neoaliturus*.

      - Although these genera are not present in New Zealand, they are in the family Cicadellidae, subfamily Deltocephaline, which is well represented in New Zealand;

      - Another species in the same subfamily, *Macrosteles fascifrons*, is an experimental vector. One member of this genus is present in New Zealand, so may be able to act as a vector.

e) PCR is likely to detect *S. citri* in *Prunus* plants for planting.

   i. Detection of *S. citri* by PCR is very sensitive, fast and more reliable than woody indexing and culturing[10];

   ii. It is considered important to grow plants under conditions likely to be conducive to the disease, even when using PCR for detection, based on information that, in *Citrus*, *S. citri* may be unevenly distributed and present at very low levels, as described by Shi et al., 2014[11]. Similarly, as identified in the risk analysis, sampling of *Prunus avium* orchards showed that the number of trees in which *S. citri* could be detected varied between seasons and years.

(135) The optimal temperature range for *S. citri* to multiply and produce symptoms is between 28°C and 35°C (in *Citrus*)[10]. As such it is proposed that samples for PCR should be collected following the four week period of growth between 25°C and 30°C, described in Part 4.1.1. Because of variation observed between seasons, it is proposed that mandatory testing for *S. citri* should be done in both growing seasons.

[9] Although recorded in some international databases as being present in New Zealand, MPI has no records of *S. citri* occurring here. The international records are seen as unreliable and MPI consider this pathogen to be absent from New Zealand. MPI is working to remove these records from international databases.

[10] MPI (2016) Risk Management Proposal: Import health standard (IHS) 155.02.06: Importation of Nursery Stock, schedule of special conditions for *Citrus* (including *Citrus*, *Fortunella*, and *Poncirus*) from all countries. https://www.mpi.govt.nz/dmsdocument/14137.

[11] Shi, J., Pagliaccia, D., Morgan, R., Qiao, Y., Pan, S., Vidalakis, G., & Ma, W. (2014). Novel diagnosis for citrus stubborn disease by detection of a Spiroplasma citri-secreted protein. Phytopathology, 104(2), 188-195.

4.3.1.2 *Xylella fastidiosa*

(136) Specific phytosanitary measures in post entry quarantine, namely quantitative PCR (qPCR) testing over two growing seasons using samples taken from plants growing under summer-like conditions, are justified and sufficient to manage the risk from *X. fastidiosa* on *Prunus* plants for planting for the following reasons:

a) *X. fastidiosa* has the potential to cause economic, environmental and social impacts if introduced into New Zealand.

i. *X. fastidiosa* causes devastating diseases in crops which are important to the New Zealand economy, including grapes and citrus;

ii. *X. fastidiosa* causes phony peach disease, which can be a major factor limiting peach production;

iii. *X. fastidiosa* is known to be capable of infecting native New Zealand plant genera including iconic species such as pōhutukawa and kauri.

b) *X. fastidiosa* is likely to be able to establish in New Zealand.

i. Known host plants are present in New Zealand;

ii. The New Zealand climate is likely to be suitable for establishment.

c) There is the potential for *X. fastidiosa* to be transmitted to other hosts if it were to arrive in New Zealand.

i. At least one known vector of *X. fastidiosa* is present in New Zealand. Many other insect species in the same family as the known vector are present in New Zealand, and are potential vectors of *X. fastidiosa*.

d) *X. fastidiosa* may not be detected by visual inspection of *Prunus* plants for planting.

i. Symptoms vary between *Prunus* spp. and cultivars, and may not be reliable to diagnose infection by *X. fastidiosa*;

ii. Asymptomatic infections frequently occur in many hosts, often for a long time after inoculation.

e) Molecular diagnostic techniques are known to be a reliable and sensitive method for detecting *X. fastidiosa*.

(137) It is proposed that samples for qPCR testing should be taken following a four week period of growth between 25°C and 30°C to maximise the likelihood of detecting *X. fastidiosa*, for the following reasons:

a) The optimal temperature range for growth of *X. fastidiosa* is between 25°C and 32°C, based on *in planta* and *in vitro* experiments[12]. Low temperatures may limit disease progression and higher temperatures may limit survival of *X. fastidiosa*[12];

b) There is evidence that the bacterium does not move into the new season's growth until the middle of summer[13]. For deciduous plant species including *Prunus* spp., *X. fastidiosa* could be detected in leaves collected during summer, but not in asymptomatic leaves collected earlier in the season.

[12] Feil, H., & Purcell, A. H. (2001). Temperature-dependent growth and survival of *Xylella fastidiosa in vitro* and in potted grapevines. Plant Disease, 85(12), 1230-1234.

[13] Anon (2016). PM 3/82 (1) Inspection of places of production for *Xylella fastidiosa*. Bulletin OEPP/EPPO 46(3), 407–418

(138) There is some evidence that early infections may lead to false negative results[14], and there are still significant knowledge gaps around the latency period of *X. fastidiosa*. Some observations from recent conferences suggest latent periods may range from 3 -14 months depending on strain and host, although there is some evidence that symptoms may develop relatively rapidly in susceptible *Prunus* cultivars[15]. Hence, testing must be done in both growing seasons to provide a very high degree of certainty that plants are free from *X. fastidiosa*.

4.3.2 Fungi and oomycetes

(139) Twenty one species of fungi and oomycetes were considered as regulated pests on *Prunus* plants for planting in the MPI risk analysis.

a) As noted in paragraph (33), only a limited number of fungi, identified using major literature sources, were considered as part of the hazard identification and risk assessment.

b) This means that some species of regulated fungi and/or oomycete, in particular those where risk will be managed by the generic measures of the draft standard (for example growing season inspection) may not be listed in the standard. If such species are identified on *Prunus* plants for planting, their regulatory status will be assessed with reference to the MPI BORIC database.

(140) The risk analysis showed that risk from some of the fungi and oomycetes considered as regulated pests would be appropriately managed in post entry quarantine without any risk management measures other than growing season inspection. This is because visible symptoms are expected to become evident over the proposed 21 month period of post entry quarantine under environmental conditions described in Part 4.1.1, based on information in the risk analysis.

a) This applies to the following species:

i. *Apiosporina morbosa* (disease symptoms reported as developing rapidly in spring with no evidence symptoms will not become evident within two growing seasons);

ii. *Blumeriella jaapii* (infections established in a greenhouse-controlled environment held at 26 (±3)°C in daytime and 20 (± 3)°C at night time with 70–90% relative humidity);

iii. *Naganishisa usbekistanensis* (limited evidence about the pathogenicity and impacts of this species, with only a single record from *Prunus*, additional measures not justified);

iv. *Passalora circumscissa* (disease development favoured by temperatures of 20°C to 25°C and high humidity, rain and dew);

v. *Phomopsis vexans* (no specific information provided in the risk analysis regarding conditions required for disease development on *Prunus* spp., but additional measures not considered justified);

vi. *Phytophthora palmivora* (disease symptoms on cherry and apricot visible within three months when plants incubated between 20°C to 30°C);

vii. *Phytophthora parsiana* (maximum disease incidence on almond at 25°C to 32°C and, in a separate study, symptoms visible on almond within 4 months. No disease symptoms were observed in almond seedlings grown at 18°C to 25°C);

[14] EFSA Panel on Plant Health (PLH). (2015). Scientific Opinion on the risks to plant health posed by Xylella fastidiosa in the EU territory, with the identification and evaluation of risk reduction options. *EFSA Journal*, *13*(1), 3989.
[15] EFSA Panel on Plant Health (PLH), Bragard, C., Dehnen-Schmutz, K., Di Serio, F., Gonthier, P., Jacques, M. A., ... & Milonas, P. (2019). Update of the Scientific Opinion on the risks to plant health posed by Xylella fastidiosa in the EU territory. *EFSA Journal*, *17*(5), e05665.

viii. *Phytophthora tropicalis* (no specific information found about conditions under which disease develops. Symptoms observed on inoculated apricot seedlings within three months in screenhouse plants watered to field capacity);

ix. *Podosphaera clandestina* (leaf infections develop around four to six weeks after bud break, conidia take four to six days to develop at high relative humidity (>95%) between 15°C to 25°C);

x. *Taphrina communis* (symptoms on leaves, shoots and fruit become evident 6-8 weeks after bud break, but leaf and stem symptoms not always conspicuous. Unlikely to be a major pathogen so additional measures not considered justified);

xi. *Polystigma rubrum* (causes leaf spot leading to partial or complete defoliation, with some evidence of overwintering on bark. Given the weak host association with dormant cuttings additional measures not considered justified).

4.3.2.1 *Ceratocystis* spp.

(141) Specific phytosanitary measures in post entry quarantine, namely testing using PCR, are justified and sufficient to manage the risk from members of the *Ceratocystis* genus on *Prunus* plants for planting for the following reasons:

~~a)~~ *C. variospora*[16], and potentially other members of the North American clade of this genus, are pathogenic towards multiple species of *Prunus*. In particular, *C. variospora* causes perennial cankers that can lead to limb or tree death.

b) Growing season inspection combined with PCR testing is likely to result in effective detection of *C. variospora* and related species because:

i. Disease symptoms are likely to become evident in post entry quarantine:

- Almond trees artificially inoculated with *C. variospora*, displayed visible symptoms within 18 months of inoculation[17], with canker development in almond being more rapid at higher temperatures (29°C) than lower (e.g. 21°C and 24°C)[18];

- All *Prunus* plants will be exposed to environmental conditions likely to be conducive to expression of symptoms of infection with *C. variospora* (described in paragraph (101)).

ii. Plant samples must be tested for *Ceratocystis* spp. by PCR using primers that will detect all members of the *Ceratocystis* genus. PCR testing must be done using stem samples collected at the end of the first summer growth period, and again at the end of the second summer growth period. This increases the likelihood of detecting latent infections and is considered necessary given the need for MPI to have a very high degree of certainty that members of the *Ceratocystis* genus are not present in imported plant material.

c) The proposed measures are consistent with those previously consulted on to manage risk from *C. fimbriata* on *Actinidia* plants for planting. MPI is currently developing PCR primers that will detect members of the *Ceratocystis* genus including those recorded as infecting *Prunus*.

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[16] It is noted that the existing standard records *C. fimbriata* as a regulated pest of *Prunus*. There is now good evidence that the species which infects *Prunus* is *C. variospora*, so the revised standard has been updated to reflect this.

[17] Teviotdale, B. L., & Harper, D. H. (1991). Infection of pruning and small bark wounds in almond by *Ceratocystis fimbriata*. Plant Disease, 75(10), 1026-1030.

[18] Moller, W. J., DeVay, J. E., & Backman, P. A. (1969). Effect of some ecological factors on Ceratocystis canker in stone fruits. Phytopathology, 59.

4.3.2.2 *Monilinia* spp.

(142) Five species of *Monilinia* (*M. fructigena*, *M. kusanoi*, *M. mumeicola*, *M. polystroma* and *M. yunnanensis*) meet the criteria to be regulated pests for New Zealand.

(143) Specific phytosanitary measures in post entry quarantine, namely testing using PCR or plating onto suitable isolation medium are justified and sufficient to manage risk from the named *Monilinia* spp. on *Prunus* plants for planting for the following reasons:

a) These species are perceived as presenting a significant biosecurity threat to the New Zealand stonefruit industry.

i. There is some uncertainty about potential impacts (because it is unclear how exotic species would interact with *M. fructicola*, which is already present in New Zealand);

ii. However, given the potential for high impacts a high degree of certainty is required to ensure new members of this genus are not introduced into New Zealand.

b) *Monilinia* spp. are most conspicuous on infected fruit and blossoms, but other plant parts including leaves, twigs and branches may also be infected. Plants for planting are a known means by which *Monilinia* spp. can be spread and it is known that buds may be latently infected. It is considered possible (although unlikely) that visual inspection may not manage all risk given that plants will not flower or fruit in post entry quarantine;

c) Both PCR or plating onto suitable isolation medium are widely accepted as suitable diagnostic techniques for members of the *Monilinia* genus (for example as summarised by the European Food Safety Authority[19]).

4.3.2.3 *Phaeoacremonium parasiticum* and *P. minimum*

(144) Specific phytosanitary measures in post entry quarantine, namely testing using PCR or plating onto suitable isolation medium are justified and sufficient to manage risk from *P. parasiticum* and *P. minimum* on *Prunus* plants for planting for the following reasons:

a) These species have a broad host range and are recorded as causing disease on economically significant crops in New Zealand including apple, grapevine and kiwifruit. They have also commonly been reported from *Prunus* plants showing severe decline symptoms;

b) Although there is no evidence of asymptomatic infections in *Prunus*, these species are known to be present as asymptomatic endophytes in other host species, including grapevine and kiwifruit plants;

c) No evidence was provided about what conditions are conducive to expression of symptoms from these species. Exposure to the broad range of conditions proposed in part 4.1.1 is considered likely to maximise the likelihood of symptom expression;

d) PCR-based detection or culturing on suitable isolation medium are both recognised as appropriate methods to detect *Phaeoacremonium* spp., although PCR is likely to be more sensitive[20,21].

[19] EFSA Panel on Plant Health (PLH); Pest risk assessment of Monilinia fructicola for the EU territory and identification and evaluation of risk management options. EFSA Journal 2011;9(4):2119. [155 pp.] doi:10.2903/j.efsa.2011.2119. Available online: www.efsa.europa.eu/efsajournal

[20] Aroca, A., & Raposo, R. (2007). PCR-based strategy to detect and identify species of *Phaeoacremonium* causing grapevine diseases. *Appl. Environ. Microbiol.*, *73*(9), 2911-2918.

[21] Martín, M. T., Cobos, R., Martín, L., & López-Enríquez, L. (2012). Real-time PCR detection of Phaeomoniella chlamydospora and *Phaeoacremonium aleophilum*. *Appl. Environ. Microbiol.*, *78*(11), 3985-3991.

4.3.2.4 *Phytophthora drechsleri* and *P. ramorum*

(145) Specific phytosanitary measures in post entry quarantine, namely testing using PCR or plating onto suitable isolation medium are justified and sufficient to manage risk from *P. drechsleri* and *P. ramorum* on *Prunus* plants for planting for the following reasons:

a) These species have a very wide host range and cause a range of symptoms including rapid tree death. *P. ramorum* is recognised by MPI as a priority disease of concern to plant health;

b) Given evidence suggesting that these two species may not induce visible disease symptoms within the proposed 21 month period of post entry quarantine, even when grown under the broad range of environmental conditions proposed in part 4.1.1, relying solely on growing season inspection is not considered appropriate as the sole method of diagnosis;

c) PCR-based detection or culturing on suitable isolation medium are both recognised as appropriate methods to detect *Phytophthora* spp., for example as identified when MPI recently consulted on import requirements for *Actinidia* plants for planting.

(146) Note that MPI is currently conducting a research project to develop PCR primers that will effectively detect regulated *Phytophthora* species in plant material.

4.3.3 Phytoplasmas

(147) Multiple species of phytoplasma including '*Candidatus* Phytoplasma mali', '*Ca*. Phytoplasma pruni' and '*Ca*. Phytoplasma prunorum' are regulated pests on *Prunus* plants for planting.

(148) Specific phytosanitary measures in post entry quarantine, namely testing using PCR, are justified and sufficient to manage the risk from phytoplasmas on *Prunus* plants for planting for the following reasons:

a) Phytoplasmas are known to cause serious disease of *Prunus* spp. and multiple other plant genera. As an example, X-disease (caused by '*Ca*. Phytoplasma pruni') is one of the most serious diseases known in peach;

b) Phytoplasmas may not be detected by visual inspection of *Prunus* plants for planting given that asymptomatic infections may occur;

c) Universal PCR primers are available to detect all known species of phytoplasma, and are known to be highly sensitive. These primers are likely to detect all species of phytoplasma because they have been designed around highly conserved regions of the genome. The primers are regularly checked against the sequences of all isolates in the public sequence database by staff at the PHEL diagnostic facility, to help ensure ongoing effective detection of any phytoplasma that may be present in imported plants. Phytoplasma titre is likely to be higher after plants have been grown under summer-like conditions, so samples for testing will need to be taken towards the end of the four month period of summer-like conditions.

4.3.4 Viruses

(149) As noted in Chapter 8 of the import risk analysis, the hazard identification showed that many viruses listed in the existing import health standard are associated with *Prunus* plants for planting and continue to meet the criteria to be considered regulated pests for New Zealand. These species were not considered further as part of the risk analysis. For all of these species it is proposed that the testing measures in the revised standard should remain largely unchanged, with the exception of woody indicator testing, as discussed in part 4.3.4.4.

(150) Five virus species listed in the existing standard are proposed for removal from the revised standard because they are no longer considered a hazard, namely:

a) Apricot deformation mosaic virus;

b) Cherry line pattern and leaf curl virus;

c) Cherry rough fruit virus;

d) Peach yellow leaf virus;

e) Prunus virus S.

Based on information in the risk analysis, these species were not considered further in this risk management proposal, and have been removed from the draft standard.

(151) A targeted pest risk analysis was completed for some other species of virus that are either not listed in the existing standard, or that are listed in the existing standard, but where further assessment was deemed necessary. Conclusions from targeted risk analyses (see Chapter 8 of the import risk analysis) fell into three different categories, as follows:

a) Viruses meet the criteria to be regulated pests;

b) Viruses do not meet the criteria to be regulated pests;

c) Viruses may meet the criteria to be regulated pests.

(152) Viruses that fell into each of the above categories are discussed in the following paragraphs.

4.3.4.1 Viruses that meet the criteria to be regulated pests:

(153) Three species of virus were considered to meet the criteria to be regulated pests and have been included in the revised standard, as follows:

a) *Apricot latent ringspot virus*

i. The risk analysis concluded that growing season inspection should be considered sufficient to manage the risk.

ii. It is noted that this virus is also likely to be detected by herbaceous indexing using *Chenopodium quinoa*, which is required for other virus species.

b) Cherry rusty mottle diseases

i. The causal agents have not been identified, but there is evidence suggesting these diseases are caused by closely related viruses of the family *Betaflexiviridae*.

ii. The existing standard lists Cherry rusty mottle virus as a regulated pest, with a requirement for woody indicator testing. As identified in the risk analysis, the recognised name for this species is now *Cherry rusty mottle associated virus*, and this is understood to be one of the related *Betaflexiviridae* viruses responsible for causing Cherry rusty mottle diseases.

iii. The risk analysis concluded that whilst these diseases should be considered regulated pests, they do not meet the criteria for risk management measures other than growing season inspection, given the limited potential impact and the likelihood that they are only, or predominantly, graft transmissible.

iv. Based on the above information, the existing requirement for woody indicator testing has been removed. Risk from these diseases will be managed by growing season inspections. It is noted that PCR primers capable of detecting members of the Robigovirus genus are available, which can detect *Cherry rusty mottle associated virus*.

c) *Prunus necrotic ringspot virus* (almond calico and cherry rugose mosaic strains)

i. The risk analysis concluded that the almond calico and cherry rugose mosaic strains of *Prunus necrotic ringspot virus* are not present in New Zealand and meet the criteria to be regulated. Strains not present in New Zealand are currently listed as regulated in BORIC.

ii. The risk analysis noted that there is a high degree of uncertainty in regards to what strains of this virus are present in New Zealand, but that, based on pathogenicity evidence only mild strains are present, and not the two severe strains identified above.

iii. Based on existing knowledge, it is not possible to distinguish between severe and mild strains using molecular techniques. It is known that there may be asymptomatic infections from *Prunus necrotic ringspot virus*.

iv. Based on the above, given that the two named strains can induce severe symptoms, and taking into account that PCR testing cannot distinguish between strains, it is proposed that these strains should continue to be regarded as regulated (because they would likely cause increased impacts to the *Prunus* growing industry), with risk managed using growing season inspection. If severe symptoms were seen on plants in post entry quarantine and attributed to *Prunus necrotic ringspot virus*, a decision would be made at the time in regards to the identity of the strain.

4.3.4.2 Viruses that do not meet the criteria to be regulated pests

(154) Fifteen species of virus did not meet the criteria to be regulated pests. These species were not considered further in this risk management proposal, and are not listed in the standard.

a) *Apple stem pitting virus*;

b) *Apricot vein clearing-associated virus*;

c) *Asian prunus viruses 1, 2* and 3;

d) *Nectarine marafivirus M*;

e) Peach-associated luteovirus;

f) Peach chlorotic leaf spot virus;

g) *Peach chlorotic mottle virus*;

h) Peach leaf pitting-associated virus;

i) *Peach marafivirus D*;

j) Peach virus T;

k) *Prunus virus F*;

l) *Prunus virus T*;

m) *Tobacco necrosis virus*;

n) *Tobacco ringspot virus*.

Some of the viruses listed above are recently described and there is very little information about potential impacts they may have on *Prunus* plants for planting. As such, for some species, there was a high degree of uncertainty in the risk analysis conclusion. These species have not been considered further in this risk management proposal, or added to the revised standard. However, if new information becomes available indicating that they may have an impact, their status as regulated pests will be reconsidered.

4.3.4.3 Viruses that may meet the requirements to be regulated pests

(155) The risk analysis concluded that four additional species of virus may meet the criteria to be considered regulated pests but that there was significant uncertainty in the conclusions. Risk management measures for these species were considered further in this risk management proposal; proposed risk management requirements are identified below:

a) *Apricot pseudo-chlorotic leaf spot virus*. It is proposed that *Apricot pseudo-chlorotic leaf spot virus* should not be regarded as a regulated pest of *Prunus*, for the following reasons:

i. The potential impact of the virus remains unknown.

- The virus has only been found in mixed infections, especially with *Apple chlorotic leaf spot virus*, which is present in New Zealand. This means that it is difficult to distinguish the symptoms of *Apricot pseudo-chlorotic leaf spot virus*, and it is not known what economic impact the virus is likely to have. *Apricot pseudo-chlorotic leaf spot virus* has a wide global distribution and has been reported from multiple countries since 2005, without evidence of severe impacts;
- It is noted that the virus is considered unlikely to be detected during growing season inspections in post entry quarantine. If introduced, it is considered to have the potential to establish in New Zealand.

ii. *Apricot pseudo-chlorotic leaf spot virus* is unlikely to spread widely if introduced to New Zealand.

- The virus is graft transmissible and mechanically transmissible in some herbaceous plants. There is no information on other transmissions routes, such as insect vectors;
- This means that the virus is unlikely to spread beyond cultivars in which it is originally introduced.

iii. Impacts of the disease would not be felt beyond the stonefruit industry

- Apricot pseudo-chlorotic leaf spot virus has only been recorded from Prunus species.

b) *Cherry associated luteovirus.* Given the recent identification of *Cherry associated luteovirus*, and because it has only been recorded from two countries, a precautionary approach is being applied until more information becomes available. It is proposed that *Cherry associated luteovirus* is regarded as a regulated pest, with a requirement for growing season inspection in post entry quarantine, for the following reasons:

i. *Cherry associated luteovirus* is a newly described virus, first recorded in 2017.

- There remains uncertainty about symptoms and potential impacts from this virus, given that it has been found in mixed infection with other important plant viruses;

ii. *Cherry associated luteovirus* is considered likely to spread within the stonefruit industry if it establishes in New Zealand.

- The virus is aphid transmitted, and luteovirus transmitting aphids, including green peach aphid, are present in New Zealand and reported from stonefruit;
- *Cherry associated luteovirus* has only been recorded from *Prunus* species, so impacts of the disease are unlikely to be felt beyond the stonefruit industry.

iii. The risk analysis concluded that, if considered a regulated pest, *Cherry associated luteovirus* does not meet the criteria for risk management measures other than growing season inspection.

c) *Nectarine stem pitting associated virus*. It is proposed that *Nectarine stem pitting associated virus* is regarded as a regulated pest, with a requirement for growing season inspection in post entry quarantine, for the following reasons:

i. *Nectarine stem pitting associated virus* is a recently identified virus, first detected in symptomatic plants in 2015.

- There remains uncertainty about specific symptoms. The virus has been detected in plants displaying various symptoms, although this has been in plants in which other viruses were also detected;
- Given the recent identification of *Nectarine stem pitting associated virus*, and because it has a reasonably limited distribution (only recorded from five countries), a precautionary approach is being applied until more information becomes available.

ii. *Nectarine stem pitting associated virus* is considered likely to spread within the stonefruit industry if it establishes in New Zealand.

- The virus is a luteovirus, and these are known to be aphid transmitted. Luteovirus transmitting aphids, including green peach aphid, are present in New Zealand and reported from stonefruit;
- *Nectarine stem pitting associated virus* has only been recorded from *Prunus* species, so impacts of the disease are unlikely to be felt beyond the stonefruit industry.

iii. Measures beyond growing season inspection are not proposed based on current evidence.

- It is noted that there are some reports of asymptomatic infections of *Nectarine stem pitting associated virus*, meaning that it is possible this virus may not be detected in infected plants in post entry quarantine;
- As described in Part 2.3 of this risk management proposal, the required strength of a measure depends on the risk posed by a particular regulated pest on a particular pathway and is determined by a combination of the consequences the pest may cause if it was introduced into New Zealand and the likelihood that the pest will enter and establish from a pathway. In this case, given the uncertain impacts of *Nectarine stem pitting associated virus*, additional measures in post entry quarantine are not considered justified at present.

4.3.4.4 Testing measures for viruses

(156) A combination of some, or all, of the following measures are proposed to manage risk associated with regulated viruses listed in the standard:

a) Growing season inspection for signs and symptoms of virus infection;

b) Mandatory testing by PCR using leaf samples collected after plants have been grown in spring-like conditions for at least two months (see part 4.1.1 for the proposed conditions);

i. For *Plum pox virus*, it is proposed that two sets of PCR testing should be done (using samples collected in spring in both the first and the second growing season).

c) Herbaceous indexing using a combination of the following indicator species:

i. *Chenopodium quinoa*, *Cucumis sativus*, *Nicotiana occidentalis* and *Nicotiana benthamiana*;

ii. Viruses for which herbaceous indexing is required are identified in Table 1;

(157) The measures described above are considered justified, and appropriate, for the following reasons:

a) Plant viruses have commonly been identified in plants in post entry quarantine in New Zealand during growing season inspections. However because some viruses can cause

latent infections[22], growing season inspection will not manage risk from all regulated virus species to an appropriate level;

b) PCR is highly specific and sensitive and is known to be an effective method to detect plant viruses that are systemically distributed throughout infected plants, including latent infections, provided that primers adequately capture sequence variability amongst different strains;

   i. Two sets of PCR testing are proposed when testing for *Plum pox virus*, one in each growing season. This reflects the potential high impact of the disease, and the fact that detection may not be reliable in shoots that are less than one year old[23].

c) Herbaceous indexing will provide additional assurance that plants are free from variant strains of mechanically transmissible viruses that may not be detected using PCR;

   i. Herbaceous indicator species identified in Table 1 are based on information in the existing standard and in the MPI *Prunus* (Stonefruit) Post-Entry Quarantine Testing Manual;

   ii. Herbaceous indexing may also detect new or emerging mechanically transmissible viruses for which reliable PCR assays are not yet available.

(158) The existing standard gives the option for ELISA testing to be used as an alternative to PCR. ELISA has not been retained as a testing option because it is generally less sensitive than PCR.

a) MPI recognise that ELISA may be a highly specific and sensitive method to detect some virus species. As such, where quantitative data is available that gives evidence of sensitivity and specificity equivalent to PCR, we would consider a request for ELISA to be considered equivalent to PCR.

(159) MPI is proposing removing the option of woody indicator testing as a method to detect viruses on *Prunus* plants for planting. This is because it is now widely seen as being of limited benefit (for example as summarised by Legrand, 2015[24]).

a) The method can provide false negative and inconsistent results. This means that the absence of symptoms in indicator plants does not necessarily prove that imported plants are free from the target regulated pests;

b) Even when woody indicator testing returns a positive result, it is recommended that the result is verified using another type of test (e.g. PCR).

(160) Despite its limitations, woody indicator testing continues to be an internationally recognised technique for dealing with diseases of unknown aetiology, and MPI acknowledge that it may still have the potential to identify new or emerging virus species, or variants of existing species that may not be detected by PCR or herbaceous indexing. However, given the drawbacks identified above, and the need to verify test results using other test methods, we no longer consider this method appropriate for use as a mandatory test for viruses on imported *Prunus* plants for planting.

(161) In some cases in the existing standard, woody indicator testing was included as an optional test, with the alternative being herbaceous indexing. In these cases, the option for woody indicator testing has been replaced with a mandatory requirement for herbaceous indexing. This applies to the following species of virus:

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[22] Maliogka, V., Minafra, A., Saldarelli, P., Ruiz-García, A., Glasa, M., Katis, N., & Olmos, A. (2018). Recent advances on detection and characterization of fruit tree viruses using high-throughput sequencing technologies. Viruses, 10(8), 436.

[23] IPPC (2018). ISPM 27 *Diagnostic protocols for regulated pests* DP 2: Plum pox virus.

[24] Legrand, P. (2015). Biological assays for plant viruses and other graft-transmissible pathogens diagnoses: a review. EPPO Bulletin, 45(2), 240-251.

a) *Apricot latent virus*;

b) *Carnation Italian ringspot virus*;

c) Cherry Hungarian rasp leaf virus.

(162) In some cases where woody indicator testing was previously required, PCR tests are now available, or there is sequence information that will allow such tests to be developed. This applies to the following species of virus, for which PCR testing has been added as a requirement:

a) *Cherry rasp leaf virus*;

b) Cherry twisted leaf associated virus;

c) *Little cherry virus-2*;

d) *Raspberry ringspot virus*;

e) Stocky prune virus.

(163) In cases where woody indicator testing is a mandatory requirement under the existing standard, but other test methods are also required (herbaceous indexing and/or PCR), the requirement for woody indicator testing has been removed, but not replaced with any other testing method. This applies to the following species of virus:

a) *Cherry leaf roll virus* strains not in New Zealand (also has PCR and herbaceous indexing);

b) *Cherry mottle leaf virus* (also has PCR and herbaceous indexing);

c) *Myrobalan latent ringspot virus* (also has herbaceous indexing);

d) *Peach enation virus* (also has herbaceous indexing);

e) *Peach mosaic virus* (also has herbaceous indexing);

f) *Peach rosette mosaic virus* (also has PCR and herbaceous indexing);

g) *Plum pox virus* (also has two sets of PCR and herbaceous indexing);

h) *Tomato ringspot virus* (also has PCR and herbaceous indexing).

4.3.4.5 High throughput sequencing as a phytosanitary measure

(164) MPI has evaluated whether to include a mandatory requirement for testing using high throughput sequencing, either as an additional test method to assess the viral phytosanitary status of imported material, or as a replacement for herbaceous indexing. The decision was made to retain herbaceous indexing as a test method and not to include high throughput sequencing at present, for the following reasons:

a) Despite known limitations of biological indexing[24], herbaceous indexing remains an internationally accepted tool for diagnosing mechanically transmissible plant pathogens including certain virus species. It is known to be capable of detecting strains that may not be identified by PCR, and/or new and emerging organisms for which molecular data is not available;

b) There are still multiple limitations that need to be resolved before high throughput sequencing can be accepted as a routine test method (for example, as summarised in Maliogka et al., 2018[25]). In particular, there are still no agreed international standards on what is considered an acceptable coverage of a virus genome to be considered a reliable

[25] Maliogka, V., Minafra, A., Saldarelli, P., Ruiz-García, A., Glasa, M., Katis, N., & Olmos, A. (2018). Recent advances on detection and characterization of fruit tree viruses using high-throughput sequencing technologies. Viruses, 10(8), 436.

positive, the acceptable number of reads for data to be considered reliable, or the depth of coverage that is required across the genome to be considered a reliable positive;

c) High throughput sequencing is not yet accepted as a routine quarantine diagnostic technique by the majority of NPPOs, including those NPPOs with similar biosecurity approaches to New Zealand;

d) MPI is actively evaluating the potential for using high throughput sequencing as a routine diagnostic method, including working in collaboration with international trading partners. This is because there will be numerous advantages to using this technique, including potential greater sensitivity than biological indexing, and more rapid testing. Staff at the MPI PHEL diagnostic facility (the only accredited diagnostic facility with current capability to do mandatory testing for *Prunus* plants for planting) do not yet have sufficient data, or a finalised standard operating procedure for using high throughput sequencing as a technique for mandatory testing. It is not considered appropriate to include high throughput sequencing as an approved diagnostic technique before it has been fully validated and procedures are finalised;

e) As soon as there is sufficient data and established procedures, MPI will update the import health standard and consult on proposed changes to testing requirements. We do not think it appropriate to give the option for this type of testing in the standard before this information is available. In the meantime, if there is data showing that high throughput sequencing (either alone or in combination with other techniques) would achieve the same outcome as the proposed testing measures for viruses (described in paragraph (156)), MPI would consider any requests for equivalence in accordance with ISPM 24. *Guidelines for the determination and recognition of equivalence of phytosanitary measures*.

Table 1: Summary of regulated virus species listed in the revised import health standard and the required disease screening measures.

Virus species	Growing season inspection	Herbaceous indexing (indicator species)[1]	PCR
American plum line pattern virus	✓	✓ (Cq, Cs, No)	✓
Apple stem grooving virus [*Prunus*-infecting strain]	✓	✓ (Cq)	×
Apricot latent virus	✓	✓ (No)	×
Apricot latent ringspot virus	✓	×	×
Carnation Italian ringspot virus	✓	✓ (Cq)	×
Cherry-associated luteovirus	✓	×	×
Cherry Hungarian rasp leaf virus	✓	✓ (Cs)	×
Cherry leaf roll virus [strains not in New Zealand][2]	✓	✓ (Cq, Cs, Nb)	✓
Cherry mottle leaf virus	✓	✓ (Cq)	✓
Cherry rasp leaf virus	✓	✓ (Cq, Cs, Nb)	✓
Cherry rusty mottle associated virus (and related *Betaflexiviridae* viruses)	✓	×	×
Cherry twisted leaf associated virus	✓	✓ (No)	✓
Little cherry virus-2	✓	×	✓

Myrobalan latent ringspot virus	✓	✓ (Cq, Cs, Nb)	×
Nectarine stem pitting-associated virus	✓	×	×
Peach enation virus	✓	✓ (Cq)	×
Peach mosaic virus	✓	✓ (Cq)	✓
Peach rosette mosaic virus	✓	✓ (Cq, Cs, Nb)	✓
Petunia asteroid mosaic virus	✓	×	✓
Plum bark necrosis stem pitting-associated virus	✓	×	✓
Plum pox virus	✓	✓ (Nb)	✓ (two sets)
Prunus necrotic ringspot virus (almond calico and cherry rugose mosaic strains)	✓	×	×
Raspberry ringspot virus[2]	✓	✓ (Cq, Cs, Nb)	✓
Sowbane mosaic virus	✓	✓ (Cq)	×
Stocky prune virus	✓	×	✓
Tomato bushy stunt virus	✓	✓ (Cq, Cs, Nb)	✓
Tomato ringspot virus	✓	✓ (Cq, Cs, Nb)	✓

Footnotes to table:

[1] Herbaceous indicator species are as follows:

Cq – *Chenopodium quinoa*

Cs – *Cucumis sativus*

Nb – *Nicotiana benthamiana*

No – *Nicotiana occidentalis*

At least two plants of each herbaceous indicator species must be used in each test. Tests must be carried out using the new season's growth from imported plants growing under spring-like conditions. Plants must be sampled from at least two positions on every plant including a young, fully expanded leaf at the top of each plant and an older leaf from a midway position. Herbaceous indicator plants must be grown between 18-25°C and must be kept in darkness for 16-24 hrs prior to inoculation. Post-inoculated indicator species must be held in a glasshouse at 18-25°C for at least 4 weeks and inspected at least twice per week for symptoms of virus infection.

[2] Cherry rosette virus/Cherry rosette disease associated virus is listed in the existing import health standard with a requirement for woody indicator testing. This has not been included in the revised standard, based on information that this disease is reported to be a complex of *Raspberry ringspot virus* and *Cherry leaf roll virus*. Both of these viruses are regulated on *Prunus* plants for planting, with a requirement for mandatory testing using herbaceous indexing and PCR.

4.3.5 Viroids

(165) Two species of viroid are recognised as regulated pests on *Prunus* plants for planting, namely *Apple scar skin viroid* and *Hop stunt viroid* (strains not present in New Zealand).

(166) Specific phytosanitary measures in post entry quarantine, namely testing using PCR are justified and sufficient to manage the risk from both species of viroid, for the following reasons:

a) Both species of viroid have the potential to cause economic impacts on *Malus* (apple) and or *Prunus* spp. if introduced into New Zealand.

b) Relying on growing season inspection for detection may not effectively manage the risk because:

   i. There is evidence that *Apple scar skin viroid* may remain latent and symptomless for up to five years;

   ii. Some cultivars of *Prunus* are tolerant to *Hop stunt viroid*, and it is not clear if symptoms would be displayed in post entry quarantine.

c) Specific testing by PCR using leaf samples (including petioles and/or mid-veins) collected after plants have been grown in summer-like conditions for at least two months (see part 4.1.1) is expected to reliably detect both species of viroid, given that they are known to cause systemic infection.

4.3.6 Diseases of unknown aetiology

(167) The MPI import risk analysis evaluated all 64 diseases of unknown aetiology that are listed in the existing *Prunus* standard. Of these, eight still meet the criteria to be considered as regulated pests on *Prunus* plants for planting, namely:

a) Amasya cherry disease (formerly listed as Amasya cherry disease agent; suspected to be of fungal origin);

b) Cherry chlorotic rusty spot disease (formerly listed as Cherry chlorotic rusty spot agent; suspected to be of fungal origin);

c) Cherry necrotic crook agent;

d) Cherry short stem agent;

e) Cherry spur cherry agent;

f) Peach red marbling agent;

g) Peach stubby twig agent;

h) Sour cherry pink fruit agent.

(168) Information about the eight diseases listed above is included in the MPI risk analysis. Some diseases of unknown aetiology not listed in the existing standard were also evaluated in the risk analysis. None of these met the criteria to be considered regulated pests.

(169) Previously, to manage risk from diseases of unknown aetiology, MPI has required a combination of growing season inspection and woody indicator testing using various *Prunus* cultivars. Similar test methods have been (and continue to be) used at offshore testing facilities. This remains the internationally accepted method for detecting these diseases, however some New Zealand industry members have indicated a desire to remove woody indexing as a testing requirement.

(170) There is uncertainty around how effective woody indicator testing is to detect all of these diseases. This is because for six of the diseases, it is not known what symptoms will develop on indicator species listed in the existing standard. For the other two diseases, there is evidence that symptoms develop on *Prunus avium* ‘Bing’ (this applies to Cherry short stem agent and Cherry spur cherry agent).

(171) Diseases of unknown aetiology have some specific characteristics that may allow a different risk management approach than used in the existing standard, as discussed in the following paragraphs. Based on these characteristics, MPI is proposing to remove woody indicator testing as a mandatory requirement of the standard and to rely on growing season inspections to manage risk. MPI is particularly interested in stakeholder submissions on this proposal.

4.3.6.1 Risk management options for diseases of unknown aetiology of *Prunus*

(172) There is often limited epidemiological information about diseases of unknown aetiology, however these are generally considered to have the following characteristics:

a) Only mechanically or graft transmissible;

b) Unlikely to cause impacts beyond the affected industries which directly benefit from the importation of new germplasm (i.e. in this case, have a host range that is restricted to members of the *Prunus* genus), and unlikely to spread beyond the cultivars in which they are imported;

c) Significant uncertainty around biology, including mode of transmission (i.e. given that the causal agent and/or vector has not been identified) and their potential impact under New Zealand conditions;

d) A high likelihood of establishment if present in plants for planting imported into New Zealand, including in commercial orchards and foundation material;

e) Potential time-lag before infection or impacts become evident;

f) Unable to be detected using molecular techniques, given that no nucleic acid sequence information is available.

(173) Taking into consideration the above characteristics, MPI has identified three options that could be considered to manage risk from these diseases, as discussed below:

a) Growing season inspection in post entry quarantine (the method proposed by MPI for inclusion in the draft standard)

i. Given the restricted host range and the limited potential for these diseases to spread other than by mechanical or graft transmission (based on current information), MPI is proposing to apply fewer interventions than in the existing standard to manage risk from diseases of unknown aetiology;

ii. Under this approach risk management by MPI will be restricted to growing season inspection whilst plants are in post entry quarantine;

iii. Because it is known that many cultivars may not display symptoms, applying growing season inspection as the sole risk management tool may not manage all risk associated with the introduction of these diseases. However, symptoms are more likely to be displayed on susceptible cultivars, which is where the diseases would have the most impact. Furthermore, if the disease is only graft transmissible, it is unlikely to spread beyond the cultivar in which it is originally introduced;

iv. Under this option, the eight diseases of unknown aetiology identified above would continue to be regarded as regulated pests. This means that, if detected in the wider environment, MPI would need to consider whether it was necessary to initiate a biosecurity response to manage risks associated with the detection. This could have impacts on orchards or nurseries that had been exposed to potentially infected plants, especially if there had been large scale multiplication and distribution of imported material before symptoms became evident;

v. With regards to this option, it is noted that two of the diseases of unknown aetiology (Amasya cherry disease and Cherry chlorotic rusty spot disease) are suspected to be of fungal origin. If this is the case, these diseases may be able to spread by means other than grafting.

b) Risk management by industry

i. MPI could consider de-regulating all diseases of unknown aetiology and relying on industry to mitigate the risk as they see fit;

ii. Because there is still considerable uncertainty around the biology and aetiology of many of these diseases, including uncertainty regarding modes of transmission (i.e. given that the causal agent and/or vector has not been identified), it is possible that a disease could spread more widely than expected before it was detected. This could limit the effectiveness of post-border management by industry;

iii. The reason this approach could be considered for diseases of unknown aetiology of *Prunus* is because spread of diseases that are only graft transmittable is likely to be able to be easily managed through the removal of any contaminated lines, and because any impacts are only likely to be on the *Prunus* industry. It is also noted that, for this type of disease, any infected material imported for research and development (e.g. breeding programmes) is less likely to result in significant impacts, as disease impacts would be resolved before any material is made available for commercial distribution;

c) Retaining the existing requirement of growing season inspection and woody indicator testing

i. This option may provide greater certainty that imported plants are free from diseases of unknown aetiology. This is because indicator cultivars that may be more susceptible to such diseases would be tested before plants are released from quarantine. This approach would be consistent with the current internationally recognised approach, and with requirements of the existing standard;

ii. If testing is not done prior to export, it would need to be done on arrival in New Zealand. This would rely on the New Zealand diagnostic facility having the resources and expertise to do such testing;

iii. Woody indicator testing continues to be an internationally recognised approach for dealing with diseases of unknown aetiology of *Prunus*, despite known limitations with this approach, including the following:

- Even if disease symptoms are observed on woody indicators, if the organism causing the disease symptoms is unknown (which is the case for all diseases of unknown aetiology), there is no practical way to confirm exactly which disease of unknown aetiology is present or to validate the result with a different type of test. This may make it difficult to make regulatory decisions, especially if there are no signs of adverse effects on the originally imported plants (as opposed to the indicator species);

- For six of the eight diseases of unknown aetiology listed above, it is not known what indicator species should be used for disease detection, or what symptoms would be expressed. This means that while it may be more likely that symptoms of infection are observed on woody indicator species, there is no guarantee that this will be the case. For the other diseases, it is known that symptoms may be displayed on *P. avium* 'Bing'.

d) Despite known limitations, woody indicator testing remains the only method currently available for trying to detect diseases of unknown aetiology (unlike when testing for viruses, where multiple other test methods are usually available). This is why woody indicator testing is still used internationally as a diagnostic tool. Using this approach may increase the likelihood of detecting any diseases of unknown aetiology that are present in imported plants, especially in cases where there is information indicating that a particular disease of unknown aetiology is likely to induce symptoms on a known indicator species.

(174) If this proposal is adopted, it is proposed that the same indicators as required under the existing standard should be used for all *Prunus* spp. imported into New Zealand, as shown in the following

table. Inoculated woody indicator plants would need to be inspected for symptoms of infection for at least nine months:

Required woody indicator species	Genus of imported *Prunus* plants for planting				
	Prunus armeniaca	*Prunus avium* & *Prunus cerasus*	*Prunus domestica* & *Prunus salicina*	*Prunus dulcis*	All other *Prunus* spp.
Prunus armeniaca 'Tilton'	x3				x3
Prunus avium 'Bing'		x3			
Prunus avium 'Sam'		x3			x3
Prunus domestica 'Shiroplum'		x3	x3		x3
Prunus persica 'Elberta' or 'GF305'	x4	x4	x4	x4	x4
Total indicators	10	13	7	4	13

5. Feasibility and practicality of proposed requirements

(175) A key new risk management measure that is proposed in the draft standard is the application of environmental conditions that will be conducive to the expression of disease symptoms. In particular, this includes exposing plants to high humidity under defined temperature regimes in the summer-like period of the first growing season. MPI recognise that there may be barriers to implementing all proposed environmental requirements at existing post entry quarantine facilities in New Zealand. This is why, under this option, a three year lead in time has been proposed in terms of applying a high humidity environment. This is intended to allow facilities to make any modifications required to apply such conditions. More information about the feasibility and practicality of this measure is provided in Part 3.2.2.1.2 of this risk management proposal.

(176) An alternative risk management option is to do additional PCR testing targeted at detecting specific high risk regulated pests, as described in Part 3.2.2.1.3. As noted in that Part, it may take some time to develop all necessary PCR tests and there would need to be a staged implementation under this approach, with new tests added as they become available.

(177) Plants will remain in post entry quarantine for a minimum of 21 months before they can become eligible for a biosecurity clearance.

a) As noted above, as with other commodities, *Prunus* plants for planting can be multiplied during the post entry quarantine period. This may be done either in the Level 3B greenhouse (if sufficient space is available), in a Level 3A greenhouse in the second growing season, or by multiplying tissue cultures in a Level 3 tissue culture facility. This means that large numbers of plants, especially tissue cultures, could be available for release by the time a biosecurity clearance is issued if desired. In the case of *Prunus* plants for planting, MPI recognise that propagation by tissue culture may not be desirable given the potential for genetic drift;

b) When plants are obtained from an *Offshore Facility*, or in accordance with an *Export Plan*, there may be fewer post entry quarantine requirements on arrival in New Zealand. This means that the quarantine period may be shorter, as described in Part 3.2.1.

5.1 Import permit

(178) As described in Part 1.6 of the draft standard, an import permit will identify:

a) The regulated pests for which screening is required in New Zealand;

b) The minimum quarantine period (based on the regulated pests for which screening is required in New Zealand);

c) The level of post entry quarantine greenhouse in which consignments must be held (based the regulated pests for which screening is required in New Zealand).

(179) Listing these requirements on the import permit is considered the best way to clearly identify the phytosanitary measures that will be required for each consignment of *Prunus* plants for planting after they arrive in New Zealand. This is because when plants are produced under an *Export Plan* or are obtained from an *Offshore Facility*, some phytosanitary measures will have been applied prior to export. However, the exact measures which are applied will differ between facilities.

(180) If plants are not obtained from an MPI-approved source, the import permit will indicate that all phytosanitary measures described in the draft standard must be applied after plants arrive in New Zealand, namely that:

a) Plants must undergo all screening described in Part 2.3 of the draft standard on arrival in New Zealand before they can become eligible for a biosecurity clearance;

b) The minimum quarantine period will be 21 months, although this may be extended if regulated pests are detected;

c) Plants must be deflasked and held in a Level 3B greenhouse for the first growing season;

d) Plants may be transferred to a Level 3A greenhouse for the second growing season provided that all mandatory testing has been completed with negative test results returned and plants were effectively treated for any regulated pests that were detected during the first growing season (as described in Part 4.2.2.2);

e) The post entry quarantine facility(s) in which the plants must be held will be identified on the import permit.

(181) If plants are obtained under an *Export Plan*, or from an *Offshore Facility*, some of the required phytosanitary measures will have been applied prior to import. In this case, the import permit will identify the residual requirements that must be applied in New Zealand, including:

a) The requirements of Part 2.3 of the draft standard that must applied in New Zealand;

b) The minimum quarantine period;

c) The level of post entry quarantine greenhouse;

d) In this case, the length of the quarantine period and type of post entry quarantine greenhouse will depend on the specific regulated pests for which phytosanitary measures have been applied prior to export. This will be different for each *Export Plan* or *Offshore Facility* (see following section).

(182) The outcome of including the above details on the import permit will be that for all *Prunus* plants for planting, regardless of source, all phytosanitary measures described in the draft standard will be applied before plants become eligible for clearance.

(183) As will be stated on the permit application form, when any permit assessment begins it is unknown if or when a permit will be issued. This is because until an assessment is started MPI does not know what, if any, circumstances exist that would delay or prevent issuance of a permit. The MPI assessment will include checking the emerging risk register to ensure that any newly identified or emerging risks can be appropriately managed.

5.2 Plants from an MPI-accredited offshore facility or produced under an Export Plan

(184) The previous import health standard for *Prunus* plants for planting required plants from an accredited offshore facility to be held in a Level 2 post entry quarantine greenhouse with a minimum quarantine period of 9 months. In contrast the draft standard does not specify the level of quarantine facility, or the duration of the quarantine period, for plants obtained from an accredited facility.

a) Quarantine requirements for plants from accredited sources are not identified in the draft standard because the amount of residual risk is likely to differ between facilities. This means that plants from different facilities may have different quarantine requirements on arrival in New Zealand. The requirements will depend on multiple factors including the level of containment that is provided at each offshore facility, the specific tests that are done prior to export, and the residual phytosanitary actions that need to be applied in New Zealand in order to meet the requirements of the new standard[26];

[26] A more detailed discussion about factors considered when establishing the level of quarantine is provided in the MPI Risk Management Proposal for the Revision of the Facility Standard: Post Entry Quarantine for Plants.

b) Once the draft standard is issued the MPI Chief Technical Officer (CTO) will make a risk-based decision about the post entry quarantine requirements for plants from any accredited source. As described in Part 5.1, this will be identified on the import permit for each consignment. MPI will also update online information about each offshore quarantine facility to ensure that this information is readily available.

(185) Based on the phytosanitary measures applied at offshore facilities accredited to export *Prunus* to New Zealand, and the proposed requirements in the draft standard, it is anticipated that containment in a Level 3A quarantine greenhouse will be the minimum requirement for this type of material. This is based on the following:

a) Offshore facilities do not generally provide an equivalent level of risk management to that required in the draft import health standard for bacterial, fungal and oomycete regulated pests. This means that risk management measures for these types of organism will need to be applied in a temperature controlled quarantine facility after plants arrive in New Zealand.

i. Most offshore facilities do visual inspections for fungi and oomycetes and apply fungicide if these organisms are present, or routinely as part of a regular disease control programme. This may supress symptoms, but will not necessarily eradicate the disease-causing organism;

ii. If specific screening for fungi, oomycetes or bacteria is required in New Zealand, this will need to be done in a facility with appropriate structural and operational procedures to appropriately manage residual risk from these organisms, and with the ability to apply the required environmental conditions. As a minimum this is expected to be a Level 3A facility.

b) Facilities that hold *Prunus* plants for planting imported into New Zealand have historically been located in commercial production areas. This means that disease vectors are more likely to be present in the locality, and that there is a greater likelihood of regulated pests finding a suitable host in the wider environment if there is a breakdown in containment. As such MPI now considers that, as a minimum, plants which need residual screening on arrival in New Zealand are likely to require quarantine in a Level 3A greenhouse.

5.3 Biosecurity clearance

(186) Meeting the requirements of the standard is necessary before imported plants for planting can be considered for biosecurity clearance. However, meeting all requirements does not automatically guarantee biosecurity clearance. There are other restrictions on the giving of biosecurity clearance, as identified in sections 27 and 28 of the Act.

(187) Of particular relevance when considering biosecurity clearance for consignments of plants for planting is section 27(2)(a) of the Act. This section states that an inspector must not give a clearance for goods if he or she is aware of any circumstances or documents associated with the goods that makes it unwise for them to be given a biosecurity clearance. As part of verifying that no such circumstances apply to high value crops that may have been in post entry quarantine for a prolonged period, MPI will check the emerging risk register before goods are cleared. If any newly identified risks have been identified MPI may require additional phytosanitary measures to be applied to ensure that risk has been appropriately managed before plants are cleared. This may result in plants having to remain in quarantine for an additional period of time, whilst newly identified risk is managed.