

Horticulture Innovation Australia

Final Report

Review and Update of the National Standard for Certification of Australian Seed Potatoes

Scott Williams
Miracle Dog Pty Ltd

Project Number: PT15004

PT15004

This project has been funded by Horticulture Innovation Australia Limited using funds from the Potato Industry and funds from the Australian Government.

Horticulture Innovation Australia Limited (Hort Innovation) makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in *Review and Update of the National Standard for Certification of Australian Seed Potatoes*.

Reliance on any information provided by Hort Innovation is entirely at your own risk. Hort Innovation is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation or any other person's negligence or otherwise) from your use or non-use of *Review and Update of the National Standard for Certification of Australian Seed Potatoes* or from reliance on information contained in the material or that Hort Innovation provides to you by any other means.

ISBN 0 7341 3886 5

Published and distributed by:
Horticulture Innovation Australia Limited
Level 8, 1 Chifley Square
Sydney NSW 2000
Tel: (02) 8295 2300
Fax: (02) 8295 2399

© Copyright 2016

Contents

Summary	3
Keywords	4
Introduction	5
Methodology.....	6
Outputs.....	8
Outcomes.....	9
Evaluation and Discussion	10
Recommendations.....	11
Scientific Refereed Publications.....	12
IP/Commercialisation	13
References	14
Acknowledgements.....	15
Appendices.....	16

Summary

Certified seed potatoes underpin the multi-million dollar national potato industry including the increasing seed potato export sector. Since 2013, the Australian National Standard for Certification of Australian Seed Potatoes has been managed by the Australian Seed Potato Council (ASPC) which comprises the four respective State-based seed potato Certification Authorities.

While the four state-based Standards have been regularly updated, the Australian National Standard has not been formally updated for some time (2007). Additionally, the National Standard did not include the requirements for minituber certification.

To review and update the Australian National Standard, a comprehensive review of existing relevant background documents was undertaken (including the previous National Standard, the various State-based Standards and the international (UNECE) Standard), significant industry consultation conducted (including a major industry workshop), along with industry feedback on a revised draft version before a final updated version of the Australian National Standard for Certification of Australian Seed Potatoes was submitted to Hort Innovation in November, 2016. It is attached to this Final Report.

The revised Standard:

- Includes a comprehensive definition of terms;
- Has been totally restructured to provide easier comprehension;
- Is updated with the most recent scientific knowledge; and
- Adopts the common terminology used in the UNECE Standard, where appropriate.

It should be noted that this project developed a minimum National Standard for commercial quality and marketing requirements used for the certification of seed potato. It complements and supports other international seed potato phytosanitary Standards such as ISPM 12 and ISPM 33. It also complements interstate trading requirements and conditions.

Keywords

- Australian Seed Potato Council (ASPC)
- Certification Authority (CA)
- Department of Agriculture and food Western Australia (DAFWA)
- Horticultural Innovation Australia Limited - (Hort innovation)
- International Standards for Phytosanitary Measures (ISPM)
- PT15005 – associated project 'National Governance framework for Australian Seed Potato Certification – An Options Paper'
- Tasmanian Institute of Agriculture (TIA)
- United Nations Economic Commission for Europe (UNECE)
- ViCSPA – the Certification Authority responsible for Victoria, South Australia and northern New South Wales

Introduction

The Australian potato industry recognises the need for an Australian National Standard for the Certification of Seed Potatoes as a prerequisite for positioning itself to capitalise on the opportunities for domestic and international supply of seed potatoes.

The purpose of this project was to review and update the Australian National Standard to ensure that, irrespective of the state of origin of seed potatoes, buyers will receive seed which complies with an agreed standard. In doing so the Standard should align with the goals of the UNECE Standard, in that it can act as a reference intended to facilitate trade by:

- Creating a harmonised certification system;
- Promoting its use; and
- Defining harmonised quality requirements for seed potatoes.

Seed potato certification used to be delivered by State Departments of Agriculture as a service to their potato industry. Over the past 10 – 15 years, State governments have reduced services to agriculture and stepped back from some seed potato certification services, depending on state department preferences. This development was a driver for the formulation of a National Seed Potato Certification Standard; the most recent version of which was last published in 2007. While the National Standard has not been reviewed for some time, the four state-based standards have been regularly updated. Additionally, the existing National Standard did not include the requirements for minituber certification.

Over the last four years, liaison between the four seed potato certifying agencies and industry has been coordinated by the Australian Seed Potato Council (ASPC). The ASPC was established in 2013 and is a collaboration of all seed Certification Authorities in Australia with representation of seed growers and buyers.

Methodology

The project team used a comprehensive process of review, consultation, development of draft versions of the Standard for public comment and final review. The following method was used to review and revise the Australian National Standard for the Certification of Australian Seed Potatoes:

- Start-up meeting held with Hort Innovation;
- Team meeting to refine the method, compilation of documents and development of an initial consultation list;
- Initial and regular contact with members of project PT15005 to ensure clear lines of communication;
- Development of a unique website for the review of the National Standard and a unique email address for enquiries. The website included a copy of the current Standard and a series of questions to help guide submissions (see <http://www.seedpotatoreview.org/>). Content on the website included:

Submissions should focus on the National Standard only and should address the following questions:

- 1. Is a National Standard important for the Australian potato industry? If so why? If not, why not?*
 - 2. In what way are you impacted by the National Standard?*
 - 3. What do you consider to be the strengths of the existing Standard?*
 - 4. What do you consider to be the weaknesses of the existing Standard?*
 - 5. How could any such weaknesses be overcome by changes to the Standard? Please specify particular sections of the report to which you refer (e.g. provide section numbers or page numbers of the current Standard).*
- Communication of the existence of the review and the availability of the website for industry input was communicated regularly through normal channels (via the AUSVEG website for several weeks, HIA e-news to members, existing industry contacts etc);
 - Review of numerous background documents including:
 - The existing (2007) National Standard;
 - State-based Standards;
 - International (UNECE) Standard; and
 - PT 13010 - Seed Potato Certification Review.
 - Engagement with Certification Agencies to receive input into the redrafting of the National Standard;
 - Weekly 'project team' teleconferences;
 - Regular discussions with the project leader for PT15005 including joint teleconferences with HIA management;

- Attendance at a number of meetings which were accessed to enable direct consultation with industry including:
 - A meeting with Potato Processing Association of Australia; and
 - A meeting with minituber producers.
- Redrafting of the National standard and incorporation of minituber requirements;
- Consultation with growers, buyers, processors, certifiers and regulators;
- Development of a list of key issues for consideration at an industry workshop;
- Pre-workshop meetings with numerous members of the seed certification industry;
- Attendance and presentation at an industry workshop on June 2, 2016;
- Revision of the draft Standard based on feedback and agreements at the industry workshop;
- Circulation of the draft Standard to industry for comment (this was directly sent to all workshop attendees plus 'advertised' via AUSVEG news and website);
- Receipt of feedback from industry (submissions closed end September);
- Consideration of all feedback received; and
- Development of final version of minimum Australian National Standard.

Outputs

The following outputs were developed over the course of the project:

1. A presentation of key issues in relation to the draft Standard was made to the industry workshop (Melbourne, June 2016)
2. Progress Report for Milestone 102 – submitted to Hort Innovation (July 2016)
3. Update on progress to potato industry conference (Bendigo, August, 2016)
4. Revised draft National Standard for industry review (August, 2016)
5. Final National Standard for the Certification of Australian Seed Potatoes (November, 2016)

Outcomes

The key outcomes arising from this project are largely two-fold:

1. A comprehensive process of consultation which has enabled industry to provide input into the revision and update of the minimum Australian National Standard
2. A fully revised version of the Australian National Standard for the Certification of Seed Potatoes

Evaluation and Discussion

As noted in this report, the primary outcome arising from this project is the development of an updated version of the Australian National Standard for the Certification of Seed Potatoes. This document should now be provided to the ASPC for progression with industry.

Submissions received on the draft National Standard were largely positive, although there may remain a couple of areas that industry may wish to further consider.

Recommendations

The revised minimum Australian National Standard for the Certification of Seed Potatoes should now be passed to the ASPC for progression with industry. This process may also unearth a couple of items for further consideration as noted in this report.

Scientific Refereed Publications

Not applicable

IP/Commercialisation

As per the Research Agreement between Hort innovation and Miracle Dog for project PT 15004, resultant IP (the new National Standard) will be:

'owned by the parties as tenants in common in equal shares and co-branded by Hort Innovation, ViCSPA, DAFWA, Crookwell Seed Potato Growers and the Tasmanian Institute of Agriculture'

References

- Included in Standard

Acknowledgements

The authors wish to acknowledge the financial support provided by Hort Innovation using potato levy funds that allowed this project to proceed. The assistance and guidance of Dr Anthony Kachenko of Hort Innovation through the process is also acknowledged.

Members of the Australian Seed Potato Council and relevant state-based 'Certification Authorities' provided significant in-kind support and great assistance in identifying issues that needed to be addressed in the Standard and potential solutions. Technical information and guidance from an international perspective was provided by Dr Nigel Crump, Deputy Chair, UNECE Specialised Section Seed Potatoes. The assistance of ViCSPA staff and its agreement to share their minituber certification process is especially noted.

Finally the project team is grateful for the input provided and support received from a broad range of potato industry participants and organisations – growers, buyers, processors, researchers and advisors.

Appendices

- Australian National Standard for the Certification of Australian Seed Potatoes, November 2016

AUSTRALIAN NATIONAL STANDARD FOR THE CERTIFICATION OF SEED POTATOES

**Horticulture Innovation Australia Limited and Australian Seed Potato Council Members
(ViCSPA, DAFWA, Crookwell Seed Potato Growers, Tasmanian Institute of Agriculture)**

Final

November 2016

The project to develop this Standard has been funded by Horticulture Innovation Australia Limited using the potato industry levy funds and funds from the Australian Government. Additional support and in-kind contributions have been provided by members of the Australian Seed Potato Council.

FOREWORD

The Australian Seed Potato Council (ASPC) on behalf of its member bodies (ViCSPA, DAFWA, Crookwell Seed Potato Growers and Tasmanian Institute of Agriculture) in conjunction with Horticulture Innovation Australia has produced this 'Australian National Standard for the Certification of Seed Potatoes'. This Australian National Standard provides the minimum field and tuber production standards for disease, trueness-to-type and defects.

The certification authority for each state may have conditions that exceed those prescribed in this Australian National Standard, in which case, such conditions must be disclosed to the ASPC and published.

The Australian National Standard for seed potato certification benefits all sectors of the potato industry:

- Seed growers;
- Seed buyers;
- Domestic regulators and policy makers;
- Exporters; and
- Technologists.

The ASPC is responsible for the implementation and future development of the Australian National Standard. ASPC is an Australian coordinating group, comprising each of the state-based certification authorities, that will:

- Coordinate the various state-based agencies which certify seed crops;
- Develop an Australian training program for certification inspectors, and accredited production facilities; and
- Provide a forum for the (annual) review of the Standard, to meet industry needs and expectations.

Certification of seed potatoes will continue to be undertaken by existing inspection staff operating for current certification authorities in each state. The Australian National Standard provides a number of important benefits for all sectors of the industry. These include:

- Minimum standards for the presence of disease, and tuber quality;
- Common terminology;
- Uniform Australian labelling for both domestic and export certified seed potatoes; and
- Uniform rules and guidelines for seed production, including; rotations, hygiene, seed grades, field inspections of crops, tuber inspections, crop isolation, packaging, and transport procedures.

The Australian National Standard:

- Facilitates movement of certified seed between states;
- Fast-tracks production of new varieties;
- Promotes buyer confidence with a uniform label for all certified seed;
- Assist in the development of export markets;
- Enhances buyer confidence in the quality of the product; and
- Enhances commercial flexibility for the industry.

TABLE OF CONTENTS

FOREWORD 2

INTRODUCTION..... 5

PURPOSE OF THE STANDARD..... 5

ROLES, RESPONSIBILITIES AND LIABILITY..... 6

INTERPRETATION 7

DEFINITION OF TERMS 8

STANDARD CONCERNING THE CERTIFICATION AND COMMERCIAL QUALITY CONTROL OF SEED POTATOES..... 12

 1. Definition of produce..... 12

 2. Provisions concerning the variety 12

 3. Provisions concerning quality..... 12

 A. Minimum requirements..... 12

 B. Classification..... 12

 4. Provisions concerning records and traceability 13

 5. Provisions concerning sampling for lot inspection 14

 6. Provisions concerning sizing 14

 7. Provisions concerning presentation 14

 A. Condition of containers 14

 B. Packaging and transport of seed 14

 C. Storage of seed..... 14

 8. Provisions concerning marking 14

 A. Official label..... 14

 B. Delivery note / documentation..... 15

 C. Chemical treatment..... 16

ANNEX I: MINIMUM CONDITIONS TO BE SATISFIED IN THE PRODUCTION OF TISSUE CULTURE (G0) SEED POTATOES 17

 Foundation material introduced into the Australian certification scheme..... 17

 1. Minituber production (G0) 17

 2. Structural conditions for minituber production 18

 3. Conditions for production 19

 4. Classification 19

 5. Audit inspections 20

 6. Other rules..... 20

ANNEX II: MINIMUM CONDITIONS TO BE SATISFIED BY THE CROP; FIELD INSPECTION PROCEDURES.....21

- A. Minimum conditions to be satisfied by the crop21
 - Rotations.....21
- B. Field inspection procedures22
 - 1. Scope of inspections.....22
 - 2. Level and timing of inspection.....22
 - 3. Additional information for field inspection.....24
 - 4. Additional measures to support crop inspections24
 - 5. Removal of plants with faults mentioned in Annex III, section A24
 - 6. Second opinion inspections.....25

ANNEX III: MINIMUM QUALITY CONDITIONS FOR LOTS OF SEED POTATOES.....26

- A. Tolerances of diseases for seed potato certification at final field inspection.....26
- B. Post-harvest assessments.....27
- C. Noted fungal diseases (to be reported on inspection)28
- D. Tuber inspection procedures.....28
 - 1. Scope of inspection.....28
 - 2. Seed presented for certification.....28
 - 3. Inspection method29
 - 4. Calculation of results30
 - 5. Second opinion inspections.....30

ANNEX IV: DISPUTE SETTLEMENT31

- General.....31
- Revocation of certification.....31

REFERENCES.....33

INTRODUCTION

The Australian potato industry recognises the need for an Australian National Standard for the Certification of Seed Potatoes as a prerequisite for positioning itself to capitalise on the opportunities for domestic and international supply of seed potatoes.

The Australian Seed Potato Council (ASPC) was established in 2013 and is a collaboration of all seed certification authorities in Australia with representation of seed growers and buyers. ASPC administers the Australian National Standard (herein referred to as the Standard) for seed potato certification to ensure the conditions of the Standard meet the needs of Australian potato industry. In doing so, the Council assesses new technology and practices that can be applied to the Standard to better achieve the conditions of the Standard. ASPC will annually review and update the Standard as required.

PURPOSE OF THE STANDARD

The purpose of this Australian National Standard is to ensure that, irrespective of the state of origin of seed potatoes, buyers will receive seed which complies with an agreed standard. In doing so the Standard aligns with the goals of the UNECE Standard, in that it can act as a reference intended to facilitate trade by:

- Creating a harmonised certification system;
- Promoting its use; and
- Defining harmonised quality requirements for seed potatoes.

To reach this goal the Standard covers the following requirements controlled by certification:

- Varietal identity and purity;
- Genealogy and traceability;
- Diseases and pests;
- External quality and physiology; and
- Sizing and labelling.

This Australian National Standard is a minimum standard that guides the various state-based seed certification schemes.

In developing this Australian National Standard, the common terminology used in the UNECE Standard has been adopted, where appropriate.

It should be noted that this is a Standard for commercial quality and marketing requirements used for the certification of seed potato. It complements and supports other international seed potato phytosanitary standards such as ISPM 12 and ISPM 33. It also complements interstate trading requirements and conditions.

Certification of seed potatoes is strictly limited to the act of endorsing that the seed potatoes have been produced in accordance with the Standard for Certification of Seed Potatoes.

The method of determining compliance with this Standard is visual inspection of the growing crop and inspection of random samples of the graded product.

The Australian National Standard does not require that the certifying authorities determine varietal purity of seed potatoes crops via a laboratory test. However, variety purity is to be assessed by

Australian National Standard for the Certification of Seed Potatoes

visual observation and count of plants which are not true-to-type of the variety and that of plants of another variety. It is therefore a requirement of the certifying authority (CA) to maintain descriptions of all potato varieties that are to be certified.

Seed potatoes can only be multiplied for up to a maximum of five field generations, of which any generation may be sold as "Certified" seed provided it meets the Standard.

Applications for the certification of crops within the requirements of the Australian National Standard must be made to the relevant CA within each State.

In the development of this Standard, consideration was given to the inclusion of recognition of area freedom of pests and diseases. It was considered that area freedom is outside of the jurisdictions and responsibilities of the certification authorities and relates more appropriately to the phytosanitary conditions for trade.

In relation to exports, the International Standards for Phytosanitary Measures (ISPMs) established under the International Plant Protection Convention (IPPC) provide, *inter alia*, guidelines for the establishment of phytosanitary import regulations and the provision of phytosanitary certification. Phytosanitary certificates, in the case of seed potatoes, facilitate international trade by confirming compliance with the phytosanitary requirements of the importing country. As such, these phytosanitary requirements may be additional to those of the Australian seed potato certification standards. This includes the recognition of area of pest freedom, which is defined in IPSP No.4 'Requirements for the establishment of pest free areas'.

The IPPC sets rules, regulations, standards and guidelines for phytosanitary inspection and certification, some of which are incorporated into Australian law. The government representative National Plant Protection Organisation (NPPO) for each signatory country implements the requirements set by the IPPC. The Department of Agriculture and Water Resources (DAWR) is the representative Plant Protection Organisation of the Australian Government. State Departments of Agriculture are responsible for implementing the provisions of Australian law that aim to achieve compliance with Australia's obligations under IPPC relating to internal quarantine and interstate quarantine controls.

Additional phytosanitary measures may be imposed on interstate trade which is outside the scope of the national standard and is controlled by the relevant state authority.

It is important to emphasise that the Australian National Standard is a minimum standard for commercial quality and marketing requirements. Additional trade requirements may be imposed by the CA, phytosanitary measures for export markets, State Authorities and/or buyers.

ROLES, RESPONSIBILITIES AND LIABILITY

The quality of the marketed seed lot is the applicant's responsibility. The operation of the certification standard is the CA's responsibility. The CA may, in providing seed certification, be at risk of legal challenge and financial liability. It is the responsibility of the individual CA to ensure appropriate legal mechanisms are in place to manage liability.

Responsibility for implementing the Australian National Standard has been vested in CAs by ASPC. Operational procedures (e.g. application for certification, timeliness of requests for crop inspections, documentation, etc.) may vary slightly between CAs but, nevertheless, will comply in all respects

with the Australian National Standard.

INTERPRETATION

In these rules:

1. Headings are for convenience only and do not affect interpretation;

And, unless the context indicates a contrary intention:

2. A reference to any person includes that person's executors, administrators, successors, substitutes and assigns, including any person taking by way of novation;
3. A reference to these rules or to any other agreement, deed or document includes, respectively, these rules or that other agreement, deed or document as amended, novated, supplemented, varied or replaced from time to time;
4. Words importing the singular include the plural (and vice versa), words denoting a given gender include the other gender and words denoting individuals include corporations (and vice versa);
5. A reference to any legislation or to any section or provision of any legislation includes any statutory modification or re-enactment or any statutory provision substituted for it and ordinances, by-laws, regulations and other statutory instruments issued under any legislation;
6. References to parties, sections, clauses, schedules, exhibits or annexures are references to parties, sections, clauses, schedules, exhibits and annexures to or of these rules and a reference to these rules includes any schedule, exhibit and annexure;
7. Where any word or phrase is given a defined meaning, any other part of speech or grammatical form in respect of that word or phrase has a corresponding meaning; and
8. The word 'includes' in any form is not a word of limitation.

DEFINITION OF TERMS

The Standard adopts the following definitions:

TERM	DEFINITION
Accreditation ¹	The official process by which laboratories are approved by the CA to produce planting material for further multiplication.
Accredited laboratory ¹	A laboratory approved by a CA to produce minitubers, microtubers and plantlets for further multiplication.
Blackleg ²	Commonly used name of a bacterial disease of potatoes, generally caused by <i>Pectobacterium atrosepticum</i> (syn. <i>Erwinia carotovora</i> subsp. <i>atroseptica</i>). Similar symptoms may, however, be caused by <i>Pectobacterium carotovorum</i> (formerly <i>E. carotovora</i> subsp. <i>carotovora</i>) and <i>Dickeya</i> spp. (syn. <i>E. chrysanthemi</i>).
Certification ²	An official control procedure, which aims at ensuring the production and supply of seed potatoes which satisfy the requirements of this Standard.
Certification authority (CA) ¹	The recognised authority in each state. Currently these are: Department of Food and Agriculture Western Australian (AGWEST Plant Laboratories), Victorian Certified Seed Potato Authority (ViCSPA), Crookwell Seed Potato Growers and the Tasmanian Institute of Agriculture (TIA).
Certification officer ¹	A designated and appropriately accredited officer of a CA responsible for certifying seed.
Chilling injury ²	Consists of internal damage to the tuber caused by exposure to temperatures slightly below or slightly above freezing, even for a relatively short period of time. A greyish discolouration predominantly of the vascular tissue can occur within hours after exposure. Chilling injury results in a tuber with no, or very poor, germination.
Clonal selection ³	A system of potato propagation that starts from selected plants.
Clonal stock ²	Propagation stock of a particular variety descended from a clonally selected mother plant. Clonal stocks are subject to visual inspection (diseases and trueness-to-type) and additional testing for diseases.
Consignment ²	A quantity of seed potatoes consisting of one or more lots which have been consigned to one commercial party and is covered by one set of documents.
Contaminated field ²	A field made subject to regulatory action because of the presence of a designated pathogenic organism in the soil.
Crop ¹	The defined boundary or unit of a particular variety/generation/class of seed potatoes for which the field inspection is conducted. A crop may be grown from multiple seed lots provided they are of the same variety/generation/class of seed potatoes and their origin is recorded.

¹ Definition specific to this Standard

² Identical to definition in United Nations (2014)

³ Adapted from United Nations (2014)

Australian National Standard for the Certification of Seed Potatoes

TERM	DEFINITION
Defect¹	A non-infectious tuber abnormality caused by such things as insects, mechanical damage or other factors.
Disease²	Any disturbance of a plant caused by pathogenic organisms which interferes with its normal structure, function or economic value.
External defect²	Any tuber defect that can be detected externally. Countable tubers are those which may have a negative impact on yielding capacity or storability, or which are likely to lead to secondary infection.
Field²	A defined area of land used for cultivation of seed potatoes.
Free from²	Not present in numbers or quantities that can be detected by the application of appropriate sampling, inspection and testing procedures.
Field generation number²	The number of growing cycles since the first introduction in the field after micropropagation or clonal selection. (Throughout this seed scheme refers to the generation that is harvested).
Homogenous²	Uniform in composition and appearance.
<i>In vitro</i>¹	A process performed or taking place in a test tube, culture dish, or elsewhere outside a living organism. In relation to potatoes it refers to the method of production where potatoes are micropropagatively multiplied.
Initial stock²	The initial pathogen-tested microplants produced and maintained under an official control program.
Inspection²	Visual examination of plants, tubers, container, equipment or facilities by an authorised person, to determine compliance with regulations.
Label¹	The official label of the CA that is attached to each unit or lot of certified seed that provides a means for traceability to the origin and rating of the seed.
Lot²	A quantity of seed potatoes bearing the same reference number which has been prepared for marketing, and being of the same variety, category, class, size and origin.
Mechanical damage¹	Relates to physical damage of the tuber which may be caused by damage during harvesting, handling and grading.
Micropropagative multiplication³	The process of propagating plantlets of initial stock by taking nodal cuttings under aseptic conditions to produce large numbers of plantlets. The resulting plantlets are retained for further multiplication cycles or grown to maturity to provide harvestable tubers.
Origin²	Officially defined area where a lot of seed potatoes was grown.
Parent material²	Initial stock or selected plants or tubers in the clonal selection used to increase a clone of seed potatoes.
Pathogen¹	A disease-causing agent (e.g. fungus, bacterium, nematode, virus or viroid). This may include quality pests, quarantine pests and non-quarantine pests.
Pathogen-tested¹	A description applied to potatoes tested and found to be below the limit of detection (LOD) of, and therefore considered to be substantially free of pathogens.

Australian National Standard for the Certification of Seed Potatoes

TERM	DEFINITION
Pest ⁴	Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products.
Phytosanitary provisions ³	Provisions in accordance with the International Plant Protection Convention (IPPC) and the provisions determined by Australian state regulators.
Potato leaf roll disease ²	A severe virus disease caused by potato leaf roll virus (PLRV). Plants are usually smaller than healthy plants and sometimes stunted. The top of the plant is paler and the leaves are more erect than usual. Older lower leaves roll upward and become brittle, such that they can be easily broken (metallic rustling) when squeezed gently. Primary infection may cause a slight rolling of the upper leaves, sometimes accompanied by discolouration.
Primary virus infection ²	Infection occurring during the current growing season and not arising from the seed tuber.
Quality ²	The sum of all characteristics that determine the acceptance of seed potatoes in relation to the specifications of this Standard.
Quality assurance ¹	The systematic control of quality factors of a product through the whole production process to ensure that it meets market specifications. It applies to the growing, harvesting, grading, packing, transporting and marketing of certified seed potatoes to satisfy the requirements of the certifying authority.
Quality control ³	The control by the CA of all activities encountered in the process of producing and marketing seed potatoes.
Quality pest ²	A pest carried by planting material but not a quarantine pest.
Quarantine pest ²	A pest of potential economic importance to the country thereby endangered and not yet present there, or present but not widely distributed and being actively controlled.
Regulated and non-quarantine pest ²	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party.
Repacked certified seed ¹	Seed lots that are repackaged under the official control of the certifying authority and as such the traceability of origin remains.

⁴ Identical to definition in FAO (2016a)

Australian National Standard for the Certification of Seed Potatoes

TERM	DEFINITION
Rot²	<p>Rot is the disintegration of tissue as a result of the action of invading organisms, usually bacteria or fungi. Rot can be triggered by environmental factors. A tuber rot may be classified as either a wet (also called soft) or dry rot according to its external and internal appearance.</p> <p>Wet rot: tuber softening to maceration, associated with a fluid exudate, which has arisen due to a primary or secondary bacterial and/or fungal infection.</p> <p>Dry rot: tuber tissue exhibiting a sunken, necrotic lesion without the loss of fluid exudates, which may remain localized or enlarge by becoming wrinkled and mummified to encompass the whole tuber.</p>
Sampling²	The procedure of drawing at random a number of tubers, plants or parts of plants, which may be taken as representative of the lot or the field.
Sprout inhibitor²	A chemical substance, applied either to the plants during the growing season or to the tubers after harvest, which suppresses or prevents the normal development of sprouts.
Substantially free²	Not present in numbers or quantities in excess of those that can be expected to result from and be consistent with normal handling and good cultural practices employed in the production and marketing of the commodity.
Testing²	The use of one or more procedures, other than inspection for determining the presence of a pathogenic agent or for varietal identification.
Tolerance (disease, pest or defect)¹	The maximum permitted incidence / severity of disease, pest, or plant defect present in either the growing crop, or on harvested tubers, to meet a defined quality standard.
Traceability²	A system of documentation that enables the source and performance of a lot to be tracked during the classification process.
Visual examination⁵	The physical examination of plants or tubers using the unaided eye or in conjunction with a lens to detect pests or contaminants.
Tuber rating¹	The assessment of the health/defects of harvested tubers, by the certifying authority.
Zero tolerance¹	When zero tolerances are applied, certification does not mean that the seed lot or crop is free of disease, but that none was detected within the limitations of the assessment made.

⁵ Adapted from FAO (2016a)

STANDARD CONCERNING THE CERTIFICATION AND COMMERCIAL QUALITY CONTROL OF SEED POTATOES

1. Definition of produce

Produce is seed potatoes. Seed potatoes are tubers (including minitubers) and potato micropropagative material of cultivated tuber-forming *Solanum* spp. for planting and which are certified by the CA as meeting the specific requirements of this Standard. This Standard does not apply to potatoes intended for planting for:

- Trials or scientific purposes; and
- Selection work.

These, however, shall always be covered by documentary confirmation of quality by the CA.

2. Provisions concerning the variety

Varieties shall be accepted for certification under the Standard if an official description and a reference sample can be made available to the CA.

The variety should be distinct, uniform and stable according to the guidelines of the International Union for the Protection of New Varieties of Plants (UPOV) and have a denomination allowing its identification.

3. Provisions concerning quality

The purpose of the Standard is to define the quality requirements of seed potatoes after preparation and packaging, and prior to the point of sale.

A. Minimum requirements

Seed potatoes shall be substantially free from diseases and pests and from any defects likely to impair their quality as seed. They shall be substantially dry outside and, in general, of normal shape for the variety.

Neither growing crops of seed potatoes nor seed potatoes shall be treated with sprout inhibitors.

These requirements shall be observed in conjunction with the standards and tolerances set out under B on Classification.

B. Classification

Seed potatoes shall be classified according to variety and the standards given below. Their classification shall be subject to official control by the CA. The CA is responsible for the maintenance of all classification data to provide traceability.

Crops for certification may be classified as:

- I. Potatoes that are produced *in vitro* are classified as 'tissue culture' or G0. These are seed potatoes derived from pathogen-tested tissue culture. Tissue culture (G0) seed shall be directly derived by micropropagation and may be tissue culture plantlets or tubers meeting the requirements for certification of seed potatoes are specified in Annexes I, II, III and IV.
- II. Certified seed potatoes are derived from minitubers (which may include microtubers) or plantlets produced in accredited laboratories from pathogen-tested stocks maintained in tissue culture. Field-grown seed potatoes shall be classified according to the number of field generations (G1, G2 etc.) placed in one of four 'field ratings' (R1, R2, R3, and R4), as

determined by a field inspection, in combination with a 'tuber rating' (A or B) as determined by a post-harvest assessment (Annex IV, section B). The final designation of a seed lot will therefore contain a field rating and contain a field generation record (e.g. G1R2, G1R3).

Summary of seed grades sold or transferred to other seed growers ('black label')

Generations can be transferred and/or traded (1 to 4 in a 5-year scheme) between registered certified seed growers and/or contracted producers, with an official 'black label'. Such seed will have a field rating of 1 or 2, and a tuber rating of A.

Table 1. Summary of seed grades (5-year rotation)

Generation	Overall rating (Field and Tubers)	
	☑ can be multiplied for certified seed	☒ cannot be multiplied for certified seed
G1	1A or 2A	3A, B or 4A, B
G2	1A or 2A	3A, B or 4A, B
G3	1A or 2A	3A, B or 4A, B
G4	1A or 2A	3A, B or 4A, B
G5 ⁶	-	1A, B, 2A, B, 3A, B, 4A, B

Any generation of seed intended for further multiplication in a seed scheme must be of a rating that is equal to or higher than that of the next generation. (Seed with a rating of 2, for example, cannot be upgraded to a rating of 1 in the subsequent generation). Any seed having a field rating of 3 or 4 cannot be further multiplied for certified seed.

The highest number rating in any category shall determine the overall rating for that crop. (For example for a foreign variety rating of 1, virus rating of 2, and other diseases rating of 3, then the overall rating = 3).

4. Provisions concerning records and traceability

Detailed records must be kept and made available to the CA as required. The produce may not be accepted for certification if accurate records are not maintained. These records may include such details as source of seed and proof of purchase, variety, time of planting, field history, fertiliser and chemical applications, and harvest date.

⁶ At the discretion of the CA, Generation 5 may be permitted to be grown on to G6 within the seed scheme. This approval must only be given under exceptional circumstances involving a force majeure situation (i.e. an event or effect that cannot be reasonably anticipated or controlled). Examples include loss of early generation material due to flood or virus. The CA must be given the opportunity to approve the use of G5 material to be grown on prior to planting, and in so doing, be able to assess the exceptional circumstances that warrant the need to use the G5 seed stock. To be eligible the G5 stock must have a field rating 1. Full disclosure must be provided to the purchaser of the seed, in that G6 must be printed on the official label. No further multiplication beyond G6 is permitted.

5. Provisions concerning sampling for lot inspection

Sampling of seed potatoes for inspection and certification purposes shall be carried out officially or under official supervision as determined by the CA.

The grower must notify the certifying authority when the tubers are ready for certification. An officer of the authority will inspect the unwashed tubers for diseases and defects by examining random samples from each lot of produce presented for inspection.

Refer to Annex III for further detail.

6. Provisions concerning sizing

Minitubers (G0) are exempt from the minimum sizing requirements.

Certified seed shall be graded by size, weight, or number of tubers. The assessment of size of seed potatoes is done using a square-hole template as specified in Annex III.

7. Provisions concerning presentation

A. Condition of containers

Seed may only be packed and transported in new sacks, bulk bags, or bins (or used bins, or bulk trucks).

B. Packaging and transport of seed

Seed may only be packed and transported in new sacks, bulk bags, or bins (or used bins, or bulk trucks if accompanied by a cleanliness declaration certificate).

Seed that has been repacked after certification can be retained as certified seed provided that seed lot retains its origin and the process of repacking is done under the official control of the CA.

C. Storage of seed

Seed lots (generations and varieties) must be clearly and accurately labelled.

Each generation of seed must be separated in time and / or space to prevent lines from being mixed.

Seed potatoes must be separated from ware potatoes.

8. Provisions concerning marking

A. Official label

Each container shall bear on the outside an official label which has not been previously used. The label shall be black or red in accordance with Annex III.

Labels will be of a standard size and design as determined by the ASPC and will include the following details:

- Grower;
- Variety;
- Date packed;
- Approved CA;
- Field rating;
- Generation;

- Endorsement by the CA;
- Definition of certification, and grower's declaration; and
- State of origin (may be indicated).

Each label must be uniquely identifiable to ensure traceability.

Labels used for export seed will comply with export standards and may include the following details:

- EXPORT SEED – Produce of Australia;
- Lot no. (only if required) or registered crop number;
- Variety;
- Generation;
- Month harvested;
- Month packed;
- Size;
- Approved CA;
- Endorsement by the CA; and
- Definition of certification, and grower's declaration.

All labels (domestic and export) must be serially numbered to ensure traceability.

Growers must contact the CA to request certified seed labels for the seed lots to be certified.

Labels must be attached to each container of seed intended for certification, at the time of packing.

Containers of seed potatoes must include an official certification label on each unit. The CA must take appropriate measures to ensure traceability is maintained.

When certified seed is packed into bulk containers and then loaded into a bulk truck the following conditions apply:

- Truck cleanliness – the bulk truck should be treated as a bulk bin and have a signed cleanliness declaration certificate.
- At loading of the bulk truck the labels are to be removed from the containers and only one label is to be given to the driver, to represent that lot of certified seed. The seed grower is to keep a record of the label numbers used.
- All labels removed from the containers are to be cut in half and retained for audit purposes.

Official certification labels must be securely attached to prevent loss during transport. Records must be kept of label numbers used for each seed lot.

Growers are responsible for the safe storage and correct use of official labels. The use of official labels for purposes other than those intended may result in exclusion of the grower from the certification process.

B. Delivery note / documentation

A delivery note or other appropriate documentation may accompany each lot of seed sold. In addition to certification requirements, there may be phytosanitary conditions imposed by the markets (domestic and export). These additional conditions remain outside the scope of the Standard.

The following details may be provided in the delivery note or related documentation:

- Variety;
- State of origin;
- Size category / No. of seed pieces;
- Rating (optional);
- Generation;
- Approved CA;
- Date/s of planting;
- Date of top removal or month of senescence;
- Date of harvest;
- Date of inspection;
- Postharvest fungicide/insecticide treatments applied to the seed;
- Storage conditions (i.e. cool store (degrees C), or ambient); and
- Any other relevant details.

C. Chemical treatment

Any chemical treatment of the seed potatoes shall be indicated on the outside of each container, on a tear-resistant or adhesive label printed on each container. This information may also appear inside each container. It remains the responsibility of the grower to ensure appropriate notification of chemical treatment is provided to the CA.

ANNEX I: MINIMUM CONDITIONS TO BE SATISFIED IN THE PRODUCTION OF TISSUE CULTURE (G0) SEED POTATOES

Foundation material introduced into the Australian certification scheme

Varieties shall comply with the UNECE Standard⁷ in that they are accepted for certification under the Standard if an official description and a reference sample can be made available to the CA. The variety should be distinct, uniform and stable reflecting the guidelines of the International Union for the Protection of New Varieties of Plants (UPOV) and have a denomination allowing its identification.

If there is no official description available for a given variety, then the CA may accept such varieties for certification. In doing so the CA may limit the scope in which certification is provided by denoting the variety as a breeding line.

1. Minituber production (G0)

Pathogen-tested nucleus stock

- i. All potato stocks (existing and new cultivars) acquired from whatever source for use as starting material in this certification scheme must be visually free of all diseases before being tested for the presence of the pathogens listed in Table 2 by a testing authority recognised by the CA.
- ii. To enable entry to the certification scheme, a plant health certificate or equivalent declaring the results of the pathogen testing that has been conducted for a given variety must be submitted to the CA.

Table 2. Pathogens for which tissue culture stocks must be tested, to gain inclusion in seed certification

Pathogen	Disease
Bacteria	
<i>Pectobacteria</i> (formerly <i>Erwinia</i> spp.) and <i>Dickeya</i> spp.	Blackleg and related soft rots
<i>Ralstonia solanacearum</i> (formerly <i>Pseudomonas solanacearum</i>)	Bacterial wilt
<i>Clavibacter michiganense</i> pv <i>sepedonicum</i>	Ring rot
<i>Streptomyces</i> spp.	Common scab
Fungi	
<i>Spongospora subterranea</i>	Powdery scab
<i>Rhizoctonia solani</i>	Black scurf
<i>Helminthosporium solani</i>	Silver scurf
<i>Phoma exigua</i>	Gangrene
<i>Fusarium</i> spp.	Wilt, dry rot
<i>Verticillium</i> spp	Wilt, Early Dying

⁷ UNECE (2014)

Pathogen	Disease
<i>Colletotrichum coccodes</i>	Black dot
<i>Phytophthora infestans</i>	Late blight
Viruses	
Potato leaf roll virus (PLRV)	Leaf roll
Potato virus A (PVA),	Mosaic
Potato virus M (PVM),	Mosaic
Potato virus S (PVS),	Mosaic
Potato virus Y (PVY)	Mosaic
Tomato spotted wilt virus (TSWV)	
Potato spindle tuber viroid. (PSTVd)	
Potato virus X (PVX)	Mosaic
Other	
<i>Candidatus Liberibacter solanacearum</i>	Zebra chip disease complex

- iii. The aim of this Standard is to ensure that the stock provided for further multiplication has been tested and found not to be infested or contaminated with these diseases.
- iv. The *in vitro* collection is not retested again for specific pathogens, unless it is deemed appropriate by the CA.
- v. The accredited laboratory should undertake an evaluation of environmental contamination by organisms such as fungi and bacteria using non-selective media as appropriate. In so doing, any material that is found to be contaminated should be removed from production.

2. Structural conditions for minituber production

- i. Greenhouse/polyhouse facilities must be insect-proof and approved by the CA prior to planting each crop.
- ii. The greenhouse/polyhouse must be a substantial, properly constructed, insect-proof glasshouse, polyhouse, or approved tunnel house with an insect-proof door entrance, porch or lock. The entrance porch or lock must be of sufficient area to permit the entry of people, plants and trolleys into the lock, to ensure that only one door may be open at any one time.
- iii. All openings (including evaporative cooling systems) in the facility must be covered with permanently fixed insect proof gauze. Whilst metal gauze is preferred, synthetic meshes may be used. Synthetic meshes can be approved by CA officers, provided they retain the minimum aperture dimensions when fixed in place. For this reason, welded mesh is preferred to woven mesh types.
- iv. Premises must be securely locked when unattended and after-hours access to the premises must be limited to authorised persons only.
- v. It is the responsibility of the operator to ensure that the premises and all operations comply with all local, state and federal regulations and the relevant state Environmental Protection Agency (EPA) requirements.

3. Conditions for production

- i. Initial stock must be tissue culture plantlets or microtubers produced by an approved laboratory (approved by the CA).
- ii. New growth media that is pest free must be used for each planting.
- iii. Production should be registered with the CA immediately after planting.
- iv. Inspections – two inspections are required.
 - The first inspection will be performed during optimal plant growth.
 - The second inspection will be performed just before vine kill while the plants are still green and prior to onset of senescence. It is the responsibility of the grower to schedule the inspections with the certification program.
- v. Leaf testing for viruses – plantlet populations or mini-tubers produced in an approved facility shall also be randomly tested for all diseases of concern. A minimum of 2.5% of plants in the greenhouse/polyhouse shall be leaf sampled prior to harvest and tested for five viruses (Table 3).
- vi. The diagnostic tests are to be done at a facility approved by the CA.
- vii. Leaf samples are to be collected in groups of 10 leaves and sealed in plastic bags.
- viii. The CA certification officer may request additional tests and sampling based on observations and circumstances that require further investigation.
- ix. Copies of diagnostic testing results must be forwarded to the CA accreditation officer within 10 days of the completion of testing.

Table 3. Five viruses tested on leaf samples collected from greenhouse

Virus	
Potato leaf roll virus (PLRV)	Leaf roll
Potato virus S (PVS)	Mosaic
Potato virus Y (PVY)	Mosaic
Tomato spotted wilt virus (TSWV)	
Potato virus X (PVX)	Mosaic

4. Classification

- i. Plantlets produced in *vitro* in a CA-accredited facility or approved by the CA can be used as a source propagation material for the production of minitubers. The progeny crop will be labelled generation zero or G0.
- ii. With the approval of the CA, minitubers produced in a greenhouse can be used as a source of planting material in the greenhouse and the progeny will be classified as G0 EX minitubers.

5. Audit inspections

- i. The crop (i.e. each individual variety grown) should be thoroughly visually inspected for pest and disease symptoms as listed in Annex III and for the presence of insect vectors (aphids)⁸.
- ii. If there is any doubt over possible disease symptoms being expressed by a variety being grown to be certified as initial stock, the inspector should collect leaf samples and submit them to a CA-approved diagnostic laboratory.
- iii. The inspection should confirm that no field grown seed potatoes or any other solanaceous material are present in the facility. No plants other than those potato plants being produced for certification as initial stock and listed on the application may be present in the protected environment while initial stock is being grown. If there is a connection between protected environments, a secure pest-resistant physical separation must be present between initial stock seed potatoes and all other plants being grown.
- iv. Initial stock propagative material must be planted in soil-free medium which has not been previously used to produce any crop.
- v. If containers are used, they must be thoroughly cleaned and disinfected before each use.
- vi. All varieties must be physically separated from one another by means of physical barriers to maintain varietal integrity and purity. This could be accommodated by, for example, using dividers in beds, or the growing of individual varieties in individual containers.
- vii. During the inspection, the floor-plan should be compared and its accuracy verified in relation to all varieties present.
- viii. The facility must be aphid-proof at all possible entry points (i.e., mesh screening used must have a screen hole size smaller than 70 microns (0.007 square centimetres or 0.001 square inch x 0.001 square inch), must be present on all air intakes, exhausts, vents and so on, including louvered vents). The structure should also be checked very carefully to ensure that there are no holes or tears present which could allow entrance of aphids/insect vectors.

6. Other rules

- i. The record-keeping system of the approved laboratory must document the source of the material and the volume of production.
- ii. All reasonable crop husbandry practices for the prevention or spread of pests and diseases must have been effectively carried out.

⁸ As a guide, aphids prefer and tend to congregate on soft new growth and inflorescence stems. Therefore, a number of flowers, and young leaves towards the top of the canopy, should be scrutinised for aphids. Yellow sticky traps must be present, and these should also be inspected to gauge insect activity in the environment. It is recommended that a yellow sticky trap also be present within the double door entrance between the inner and outer doors. This will help monitor possible aphid incursions at this point, and can also intercept aphids before they enter the growth area (for this reason, they should be recommended strongly to the grower).

ANNEX II: MINIMUM CONDITIONS TO BE SATISFIED BY THE CROP; FIELD INSPECTION PROCEDURES

A. Minimum conditions to be satisfied by the crop

ZERO TOLERANCE will apply to the following diseases, which automatically precludes the crop from being certified.

- a. Potato cyst nematode (PCN) (*Globodera rostochiensis* or *G. pallida*)
- b. Bacterial wilt (*Ralstonia solanacearum*)
- c. Potato spindle tuber viroid (PSTVd)

The discovery of any other zero tolerance and/or quarantine pest may automatically result in the rejection of the crop for certification.

Seed can only be produced on properties where the CA is satisfied that there is no apparent risk of bacterial wilt and/or potato cyst nematode. This will be established from historical records, appropriate soil sampling surveys (where required) and detailed knowledge of production practices on the farm and the surrounding catchment area and district.

Where PCN testing is required, seed can only be grown on land where a negative result has been obtained from a soil testing program using a PCN detection protocol as defined by the CA or as required by phytosanitary conditions imposed by the markets (domestic and export). Under no circumstances may certified seed potatoes be grown on land where PCN is known to occur.

Rotations

Land on which field generations one to three (G1 – G3) are harvested must not have grown potatoes for a minimum of five years. Land on which subsequent generations are produced (i.e. G4 and G5) must not have grown potatoes for a minimum of three years.

The CA must be satisfied that the land on which the seed crop is to be grown does not have a cropping history which would increase the risk of disease carryover.

Crop rotation is undertaken to maintain high health status of certified crops. Minimum rotational standards are required to reduce the risk of carryover of soil borne diseases from hosts such as weeds, solanaceous species or other crops.

Growers must keep proper records, including whole farm plans, which show:

- The field boundaries with field numbers or names;
- Where all potatoes are planted each year; and
- Fence line/boundary changes.

B. Field inspection procedures

1. Scope of inspections

All seed potato crops to be certified under the Standard must be inspected during growth. Inspectors from the CA may inspect crops unaccompanied and without an appointment. However, inspectors will endeavour to make appointments whenever possible.

Field inspections should be carried out in accordance with the following procedures.

The CA should adopt a risk-based approach to the inspection of ware potato crops growing in the vicinity of seed potato crops. No ware potatoes of the same variety as those submitted for certification are to be planted on any farm (including leased land) that grows certified seed without the approval of the CA.

Other measures, e.g. specifying the provenance of seed potatoes which may be planted, may also be deployed to control the health of non-seed potato crops on seed-producing farms.

All seed plots are to be clearly marked with pegs showing the variety, and the seed generation.

There must be clear separation between varieties when they are planted in the same row. This should be defined by the CA.

2. Level and timing of inspection

A minimum of at least two inspections is required for growing plants. The CA has the right to require additional inspections to ensure compliance with the Standard.

Growers are responsible for notifying the CA when their seed plots are at a suitable stage of growth for inspection. Growers should also ensure that crop desiccation occurs within an appropriate timeframe to ensure validity of certification. Additional inspections may be required if excessive time has elapsed between the second inspection and desiccation.

Certified seed plots must be inspected by an officer of the CA at least twice during their growth:

- Close to or ideally at flowering and preferably before row closure; and
- Close to, but before the crop starts to mature, or just prior to top removal.

Counts should include a traverse across the crop as well as along the rows.

As a reference for all CAs, the following is taken from the field inspection guide developed by the UNECE⁹ specialised section on seed potatoes in reference to sampling.

A representative sample of plants is inspected to determine disease infection and varietal mixture levels in the crop. They are taken at regular intervals in a randomized pattern throughout the field to ensure the inspection results are representative of disease levels and varietal mixtures in the crop. There are many methods of calculation. For example, one count may consist of 100 consecutive plants in a row. They can be counted individually or by number of steps, as indicated below.

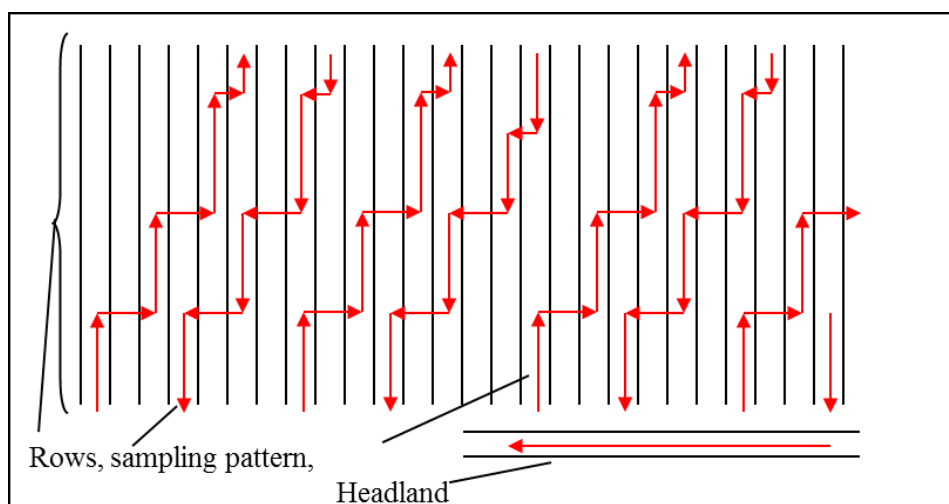
Field inspection sampling. To calculate the percentages of faults one needs to count a number of faults within the population of a known number of plants. For example when

⁹ United Nations (2015)

crossing rows one can count the number of rows and look for faults within five plants on each side. After one hundred rows and 10 plants each one has a population of 1000 plants. When one fault has been counted the percentage is 0.1%.

Field inspections by making counts: One may follow the rows, e.g. 167 steps (1m each) at a planting distance of 33cm, or 125 steps at a planting distance of 25cm, while looking over two rows will give you close to 1000 plants. It is recommended to count the plants the first time and then keep the same number of steps. In small fields one may count the plants in the row and based on that number calculate how many passes need to be made to arrive at 1000 plants. It is preferable to switch rows and not walk in a straight line when counting.

Field inspections by passes



Each red line from one end of the field to the other represents a "pass" through the crop. In each pass you normally look at both drills (rows). Look at the end rigs. The sample should be random and cover the whole crop.

The number of passes is determined in the following way. First, the share of the sample area in the total surface of the field is calculated (the size of the sample area is divided by the size of the crop). Then the number of drills in the crop is multiplied by that share, and the result is divided by 2, as two rows are inspected during each pass.

Example 1 (sample is 0.1 ha):

- In a 4.0 hectare crop with 200 drills, the number of passes would be:

$$0.1 \div 4.0 = 0.025; 200 \times 0.025 = 5 \text{ drills}, 5 \div 2 = 2.5 \text{ passes to inspect } 0.1 \text{ ha.}$$

The number of plants showing faults, as listed in the Standard, such as virus, blackleg, mixture, is recorded and used to determine the percentage in the inspector's field notes. Any plant parts including tubers not properly rogued should be included in the count of faults in the inspection sample.

3. Additional information for field inspection

All areas on the property on which potatoes are grown must be disclosed and submitted to the CA prior to the first inspection.

All seed plots should be clearly labelled to define variety and generation.

Crops will be rejected if there is any evidence of zero tolerance pests and diseases as listed in Annex III or where the field rating is greater than 4, or where there is the known detection of quarantine pests.

Seed crops may be rejected if they show poor strike, unthrifty plants, undue growth of weeds, severe hail, flood or frost damage, severe damage caused by or suspected to be caused by chemicals, or are too advanced for inspection.

Self-sown potato plants are considered to be foreign plants.

At the time of inspection crops must not exceed the listed permitted tolerances.

Crops submitted for inspection may be rejected at any stage of growth.

In certain circumstances the certifying authority may order destruction of foliage to avoid transmission of diseases.

Plant samples may be required for laboratory testing for pathogens, and these may be at the grower's expense. The results of these tests can be used as the basis of crop rejection / certification in which case the sampling strategy used should be approved by the CA.

In the event that only a part of a crop is accepted as certifiable, then the rejected part of the field must be harvested before the harvest of the remaining crop. Alternatively, the certifiable part must be harvested, graded, packed and labelled before the harvest of the rejected part and with the approval of the CA.

At the full discretion of the CA, seed stocks that have a field rating of 3 may be permitted to be grown on within the seed Scheme (Annex III). Such approval would only be granted in exceptional circumstances involving a force majeure situation (i.e. an event or effect that cannot be reasonably anticipated or controlled). Examples include loss of early generation material due to flood or virus. Additionally, the grower seeking permission cannot access other replacement stocks or utilise G5 stocks with a field rating of 1. The CA must be given the opportunity to approve the use of rating 3 materials to be grown on prior to planting, and in so doing, be able to assess the exceptional circumstances that warrant the need to use the rating 3 seed stock. Additional surveillance and testing may be a requirement of the approval by the CA. The subsequent crop must be able to pass normal standards of certification.

4. Additional measures to support crop inspections

Field inspection results will normally be determined by visual examination of the crop. Inspectors may be supported by appropriate tests when confirmation of the cause of a particular symptom is required.

5. Removal of plants with faults mentioned in Annex III, section A

The CA may permit rogueing within specified limits, provided the tolerances specified in Annex III, section A are met at the time of inspection. Rogueing must include removal of all tubers, as well as the foliage of the plant, to ensure that no affected material will be harvested.

Rogueing levels shall be at the discretion of the CA. However, as a general guide, a maximum rogueing level of 1% above the defined tolerance should be achievable in a certified crop.

6. Second opinion inspections

In the case of a disputed inspection, growers will be entitled to ask for a confirmatory inspection to be conducted by another inspector. The CA must include a documented procedure to enable such dispute resolution which may involve elevating it beyond the inspector (see also Annex IV).

ANNEX III: MINIMUM QUALITY CONDITIONS FOR LOTS OF SEED POTATOES

A. Tolerances of diseases for seed potato certification at final field inspection

Disease	Causal organism	TC or G0 (minitubers)	Final inspection rating			
			R1	R2	R3	R4
Group 1 Zero tolerance diseases¹⁰						
Brown rot (Bacterial wilt)	<i>Ralstonia solanacearum</i>	Nil	0%	0%	0%	0%
Ring rot	<i>Clavibacter michiganensis sepedonicus</i>	Nil	0%	0%	0%	0%
Potato cyst nematode ¹¹	<i>Globodera rostochiensis</i> or <i>G. pallida</i>	Nil	0%	0%	0%	0%
Potato spindle tuber viroid	Pospiviroidae	Nil	0%	0%	0%	0%
Potato wart	<i>Synchytrium endobioticum</i>	Nil	0%	0%	0%	0%
Tobacco rattle virus	Tobacco Rattle Virus	Nil	0%	0%	0%	0%
Zebra chip	<i>Candidatus Liberibacter solanacearum</i>	Nil	0%	0%	0%	0%
Group 2 Crop assessment (bacterial and fungal diseases)						
Fusarium wilt	<i>Fusarium</i> spp.	Nil	0.1%	0.25%	2%	2%
Verticillium wilt	<i>Verticillium dahliae</i> and <i>V. albo-atrum</i>	Nil	0.1%	0.25%	2%	2%
Blackleg	<i>Pectobacteria</i> (formerly <i>Erwinia</i> spp.) and <i>Dickeya</i> spp.	Nil	0.1%	0.25%	2%	2%
Max Group 2 Bacterial and fungal diseases		Nil	0.1%	0.25%	2%	2%
Group 3 Crop assessment (viral diseases)						
Potato leaf roll virus		Nil	0.01%	0.1%	1%	4%
Potato virus Y ¹²		Nil	0.01%	0.1%	1%	4%
Potato virus X		Nil	0.01%	0.1%	1%	4%
Potato virus A		Nil	0.01%	0.1%	1%	4%
Potato virus S		Nil	0.01%	0.1%	1%	4%
Tobacco mosaic virus		Nil	0.01%	0.1%	1%	4%
Potato yellow dwarf virus		Nil	0.01%	0.1%	1%	4%
Tomato spotted wilt virus		Nil	0.01%	0.1%	1%	4%
Purple top wilt		Nil	0.01%	0.1%	1%	4%

¹⁰ This list of zero tolerance diseases will by necessity change if the status of any diseases on the list changes

¹¹ Additional phytosanitary measures may be imposed on interstate trade which is outside the scope of the national standard and is controlled by the relevant state authority

¹² It should be noted that all crops for certification within the ViCSPA seed scheme require mandatory leaf and or tuber testing for PVY

Australian National Standard for the Certification of Seed Potatoes

Disease	Causal organism	TC or G0 (minitubers)	Final inspection rating			
			R1	R2	R3	R4
Max Group 3 Virus diseases		Nil	0.01%	0.1%	1%	4%
Group 4 Foreign cultivars		Nil	0.05%	0.10%	0.10%	0.10%

B. Post-harvest assessments¹³

Disease	Causal organism	TC or G0 (minitubers)	Rating A (% by tuber count)	Rating B (% by tuber count) ¹⁴
Group 5 Tuber assessment – Diseases				
Dry rots	<i>Fusarium spp., Phoma sp.</i>	Nil	2%	2%
Black scurf ¹⁵	<i>Rhizoctonia solani</i>	Nil	-	-
Silver scurf ¹⁵	<i>Helminthosporium solani</i>	Nil	-	-
Black dot ¹⁵	<i>Colletotrichum coccodes</i>	Nil	-	-
Common scab	<i>Streptomyces spp.</i>	Nil	2%	4% ¹⁶
Powdery scab	<i>Spongospora subterranea</i>	Nil	2%	4%
Root knot nematode	<i>Meloidgyne spp.</i>	Nil	2%	4%
Soft rots	e.g. <i>Pythium spp.</i>	Nil	0.25%	0.25%
Pink rot	<i>Phytophthora ethyroseptica</i>	Nil	0.25%	0.25%
Max Group 5 Tuber diseases		Nil	2%	4%
Group 6 Tuber assessment – insects and defects				
Potato moth damage	<i>Phthorimaea operculella</i>	Nil	2% ¹⁷	2%
Other insect damage	Other than <i>Phthorimaea operculella</i>	Nil	2%	2%
TOTAL INSECT¹⁸		Nil	2%	4%
Malformed tubers		n/a	2%	4%
Mechanical damage ¹⁹		n/a	2%	4%

Only one defect

¹³ For reference, examples of post-harvest defects are available at Henderson, A. and Bennett, R. (1999)

¹⁴ Crop must have an R1, R2 or R3 field rating to be eligible for tuber rating B. Only one nominated defect per seed-stock is allowed for rating B e.g. tolerance permitted for powdery scab only not combinations of defects

¹⁵ The tolerance for these diseases may be negotiated between the seed grower and the seed buyer.

¹⁶ It should be noted that the 4% level for common scab is for within Tasmania only and is an historic agreement. However, in the interest of harmonisation of interstate and export trade Tasmania should comply with the 2% tolerance

¹⁷ A tolerance of 2% damage caused by potato moth is permissible with no presence of live larvae. Tubers with more than 2 feeding holes per tuber are considered countable.

¹⁸ The total insect damage for tuber rating A is 2% and for tuber rating B is 4%

¹⁹ Mechanical damage is considered countable if the damage is greater than 3mm deep (i.e. cannot be removed with two passes of a potato peeler)

Australian National Standard for the Certification of Seed Potatoes

Skinning		n/a	5% ²⁰	5%	
Stem end discoloration		Nil	2%	2%	
Miscellaneous (e.g. sunburn)		Nil	1%	1%	
Foreign cultivars		Nil	0%	0%	
Max Group 5 Tuber diseases		Nil	2%	4%	
Group 4 Tuber sizing²¹					
Oversize		n/a	If the specified size range is ≤ 15mm, then tolerance is 4%; if > 15 mm range in size, then tolerance is 2%		
Undersize		n/a			

C. Noted fungal diseases (to be reported on inspection)

Disease	Pathogen	To be noted at field inspection	Assessed at tuber inspection
Rhizoctonia	<i>Rhizoctonia solani</i>	✓	✓
Pink rot	<i>Phytophthora erythroseptica</i>	✓	✓
Late / Irish blight	<i>Phytophthora infestans</i>	✓	✓
Leak	<i>Pythium</i> spp.	✓	✓
Sclerotinia	<i>Sclerotinia sclerotiorum</i>	✓	
Target spot	<i>Alternaria solani</i>	✓	

D. Tuber inspection procedures

1. Scope of inspection

All seed potato lots to be certified under the Standard must be inspected before marketing.

2. Seed presented for certification

Seed potatoes intended for certification must be harvested, transported, graded, packed, and stored in such a way as to preserve their identity and limit cross-contamination by diseases or varieties.

Seed graded on a harvester may be presented for inspection for certification if the tubers are practically free of soil. Field-picked and hand-graded seed potatoes are only eligible for certification if approved by the CA.

Tubers with sprouts longer than 20mm or tubers that are severely shrivelled are not eligible for certification.

²⁰ No more than 5% of tubers with 5% of surface area affected

²¹ This is done by the CA as an independent assessment and is based on the contractual arrangement between the seed buyer and seed grower. Seed size is negotiated between the seed buyer and grower and reflects the sizing printed on the official label.

3. Inspection method²²

A randomly collected sample representative of the seed potato tubers from the lot to be inspected should be gathered and set aside for tuber size, grade and quality inspection. The tubers need to be substantially free of soil to allow for a visual inspection, i.e. no caked dirt.

The grower must notify the CA when the tubers are ready for certification. An officer of the authority will inspect the unwashed tubers for diseases and defects by examining random samples from each lot of produce presented for inspection. In the case of bulk containers, a sample of 100 tubers and, in bagged lots²³, all the tubers in the bag, shall be inspected. The sample size will be determined as follows:



Figure 2: Diagrammatic presentation 'sample size' calculation

Minimum number of samples = 2

Maximum number of samples = 8

Note that all samples must meet prescribed tolerances.

For example:

1. 20 tonnes for certification in 1 tonne boxes = 20 divided by 5 = 4 samples (4 boxes).
2. 3 tonnes for certification in ½ tonne bins = 2 samples (minimum number of samples).

If the potatoes meet tuber standards at the time of inspection, the seed lot will be approved for final certification and sale.

Tubers are to be practically free of soil, and must be of good characteristic shape for the variety.

Regardless of the sampling strategy, there is zero tolerance for presence of Group 1 restricted diseases.

The standard method of grading certified seed potatoes is based on size dimensions, using a square hole template. Unless otherwise agreed to by buyer and seller prior to delivery, seed shall be graded to a standard of 35 mm to 75 mm. If grading is to be by weight, then tubers will usually be graded within the limits of 35g to 250g, unless otherwise agreed to by the buyer and seller.

²² This inspection method is consistent with AS1199.0, but has been modified to accommodate practical limitations of sampling and simplified for ease of use by certification officers.

²³ Bagged lots – defined as seed packaged in less than 50 kg vessels.

Unless an agreed level of presence of the diseases Rhizoctonia (*Rhizoctonia solani*), silver scurf (*Helminthosporium solani*) and blackdot (*Colletotrichum coccodes*) is negotiated between the buyer and the seller and specified in a written contract, their presence on tubers will not be included as a tuber defect.

Tuber samples may be taken for disease testing in the laboratory, at the grower's expense.

When a seed lot is rejected or re-graded, it is the grower's responsibility to return used labels to the CA.

Growers may choose to retain identified samples of certified seed and grow them for variety and disease identification purposes. Such plots are to be identified in the field and treated as commercial crops for isolation purposes. The produce from these crops is not to be sold as seed.

4. Calculation of results

During the inspection process a tuber should only be counted once for a defect or damage.

Calculate total counts and percentages for each disease, defect, or condition and compare with the tuber standard tolerance to determine if the lot meets the tuber standard.

5. Second opinion inspections

In the case of a disputed inspection, growers will be entitled to ask for a confirmatory inspection to be conducted by another inspector. The CA must include a documented procedure to enable such dispute resolution.

ANNEX IV: DISPUTE SETTLEMENT**General**

The CA should provide quality-oriented and value-based services in the field of third party auditing and certification/registration. The CA should conduct its certification activities in an impartial manner and exercise utmost care in managing conflict of interest and ensuring objectivity in certification process and decision making. The CA must maintain independence in certification activities without influence of any commercial, financial or other interests. In so doing, it is essential that the CA's certification decisions are based on objective evidence of conformity or nonconformity, and that any decisions made are not influenced by other interests or by other parties, and as such the CA must remain independent throughout the entire process. It is advisable that the CA have documented systems and policies in place to demonstrate its impartiality.

All disputes in relation to the provision of certification services are to be settled with the CA. The CA must have a documented and published process for handling all disputes (commercial and certification).

Matters pertaining to tolerances within this Standard should, in the first instance, be raised with the immediate CA to be included on the agenda of the ASPC.

In the case of commercial disputes, the buyer should inform the CA of the problem as soon as possible after the arrival of the consignment to allow prompt commencement of the resolution process.

Growers who fail to observe the requirements of the Australian National Standard governing the production of seed potatoes, or who act in any way against the successful implementation of the Standard, may have certification services withdrawn by the CA.

Revocation of certification

1. There are circumstances in which a certification of a seed stock has been approved, including the issue of certification labels, but information becomes available after the issuance, that warrants the revocation of the certification and labels.
2. With respect to **an individual crop**, certification may be revoked at any time if the inspector determines that the crop was subject to any of the following circumstances:
 - Incorrect information has been supplied by the applicant relating to the seed crop;
 - The crop has been exposed to sprout inhibitors or other harmful chemicals;
 - The crop is deemed not to be fit for purpose;
 - The crop has lost its identity;
 - The crop has lost its ability to propagate; or
 - The crop is infected with a restricted disease.
3. With respect to **all of the crops** produced on a farm unit, certification may be revoked at any time under any of the following circumstances:
 - The inspector determines that any one of the lots is infected with a restricted disease;
 - Any one of the lots has come into contact with a restricted disease or any common or custom equipment used on a potato operation which was infested with a restricted disease,

unless an inspector has verified that a clean-up and disinfection of the equipment had been completed before use of the equipment on the farm unit;

- The inspector determines that non-certified potatoes from another farm unit are stored with the certified seed potatoes; or
- The certified seed potatoes are stored, graded or handled with common equipment that has not been satisfactorily cleaned and disinfected after being used to handle non-certified potatoes.

If certification is to be revoked, the basis for which shall be supplied to the grower in writing.

In circumstances where certification has been revoked, the CA has the right to recall certification labels from the grower and purchasers of affected seed potatoes. In doing, so the CA may disclose the basis for the revocation of certification to other parties.

REFERENCES

- AS 1199.1 (2003), Australian Standard™. Sampling procedures for inspection by attributes. Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
- FAO (Food and Agriculture Organization of the United Nations) (2016a), International Standard for Phytosanitary Measures (ISPM) 5: Glossary of phytosanitary terms
- FAO (Food and Agriculture Organization of the United Nations) (2016b), International Standard for Phytosanitary Measures (ISPM) 33: Pest free potato (*Solanum* spp.) micropropagative material and minitubers for international trade
- Henderson, A. and Bennett, R. (1999), Product description language: potatoes. Agriculture Victoria and Australian Horticultural Corporation
- ISO (International Organization for Standardisation) (2005), General requirements for the competence of testing and calibration laboratories. ISO/IEC 17025
- ISO (International Organization for Standardisation) (2012), Conformity assessment -- Requirements for the operation of various types of bodies performing inspection. ISO/IEC 17020
- James C.W. (1977), An illustrated series of assessment keys for plant diseases, their preparation and uses. Canadian Plant Disease Survey vol. 51, no. 2 ([http://phytopath.ca/wp-content/uploads/2014/10/cpds-archive/vol51/CPDS_Vol_51_No_2_\(39-65\)1971.pdf](http://phytopath.ca/wp-content/uploads/2014/10/cpds-archive/vol51/CPDS_Vol_51_No_2_(39-65)1971.pdf))
- Plant Health Australia (2013), Industry Biosecurity Plan for the Potato Industry
- United Nations (2014), UNECE Standard S-1 concerning the marketing and commercial quality control of seed potatoes
- United Nations (2015), UNECE guide to seed potato field inspection: recommended practices (ECE/TRADE/421)