



International Rules for Seed Testing 2020

Chapter 7: Seed health testing

**Including changes and editorial corrections adopted at the
Ordinary General Meeting 2019, Hyderabad, India**

Effective from 1 January 2020

Note on the use of the translations

The electronic version of the International Rules for Seed Testing includes the English, French, German and Spanish versions. If there are any questions on interpretation of the ISTA Rules, the English version is the definitive version.

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Preface to the 2020 Edition of the ISTA Rules

Since 2014, the *International Rules for Seed Testing* (ISTA Rules) are primarily available in electronic form only. The ISTA Rules can be downloaded as a complete PDF file or as individual chapters from:

<http://www.ingentaconnect.com/content/ista/rules>

If required, users of the ISTA Rules can print their own copies. For further information on the ISTA Rules, see:

<http://www.seedtest.org/rules>

The electronic version includes the English, French, German and Spanish versions of the ISTA Rules. If there are any questions on interpretation of the ISTA Rules, the English version is the definitive version.

Seed health testing methods

Previously, the seed health testing methods were published as a separate Annex to Chapter 7 of the ISTA Rules. They are now available as separate method sheets from the ISTA web site at:

<http://www.seedtest.org/seedhealthmethods>

Details of changes

The 2020 changes are editorial corrections or Rules changes adopted at the Ordinary General Meeting held at Hyderabad, India, in June 2019. Edits were made in Adobe InDesign by Vanessa Sutcliffe of HeartWood Editorial (www.heartwoodeditorial.co.uk).

The changes in the text content from the previous edition of the ISTA Rules are listed below. They can be displayed as yellow highlighted text as a 'layer' within the electronic copy with comments on what has changed.

For the previous history of amendments to the ISTA Rules, see the Prefaces for 2003 to 2019 on the ISTA website.

Ernest Allen, ISTA Rules Committee Chair

Susan Alvarez, ISTA Rules Committee Vice-Chair

ISTA Secretariat

Changes to the ISTA Rules for 2020

General editorial

Re-labelling of Tables throughout the Rules for consistency, with Chapter number and a capital letter; subsequent cross-referencing updated:

- Table 2.1 becomes Table 2A;
- Table 2.2 becomes Table 2B;
- Table 2A becomes Table 2C;
- Table 2B becomes Table 2D;
- Table 2C becomes Table 2E;
- Table 2D becomes Table 2F;
- Table 2E becomes Table 2G;
- Table 2F becomes Table 2H;
- Table 2G becomes Table 2I;
- Table 4.1 no longer has a title, consistent with the similar table under section 3.5.1;
- Table 8.5 becomes Table 8B;
- Table 8.6 becomes Table 8C;
- Table 8.7 becomes Table 8D;
- Table 8.8 becomes Table 8E;
- Table 8.9 becomes Table 8F;
- Table 8.10 becomes Table 8G;
- Table 8.11 becomes Table 8H;
- Table 8B becomes Table 8I;
- [changed for 2019 Rules] Table 17.1 to Table 17A;
- [changed for 2019 Rules] Table 17.2 to Table 17B;
- [changed for 2019 Rules] Table 17.3 to Table 17C;
- [changed for 2019 Rules] Table 17.4 to Table 17D.

Changes to nomenclature throughout the Rules, according to the 7th edition of the *ISTA List of Stabilised Plant Names*, prepared by the Nomenclature Committee.

Introduction

I-1: Sentences added in response to a Motion concerning 'ISTA's position on integrating advanced technologies in classical seed testing methods' discussed at 2018 OGM.

Chapter 1

1.3: Editorial change requested by BSC to correct erroneous reference; approved by BSC by vote.

1.5.2.2: Editorial change required to clarify placement of specified 'species' or 'inert matter' in the Purity section on the OIC.

1.5.2.4: *Phelipanche* added where *Orobanche* is mentioned, with the assumption that the *Orobanche/Phelipanche* species concerned are parasitic plants with small dust-like seeds.

1.5.2.6: It was no longer obvious why the % of normal seedlings obtained at the end of the test period, when the test is extended, must be reported. This prescription has been removed from the Rules.

1.5.2.20: Editorial change to 'Seed mixtures' under 'Certificates'. As a general principle, any statement of the applicant may be reported only in the space reserved for applicant statements/declarations. This space is reserved at the top of the ISTA certificate under 'Stated by applicant'. Therefore, the components of seed mixtures as reported by the applicant cannot be reported under 'Analysis results' as this space is reserved for laboratory results obtained by an ISTA laboratory through seed testing.

1.5.2.20.1: Clarification on how to report purity content of seed mixtures (i.e. the percentage by weight of pure seed, inert matter, and other seeds).

Chapter 2

2.5.1.1: Revision discussed by the BSC and approved by vote, to specify that seed may also be sampled from the seed stream, including before it enters containers, as for automatic sampling. This revision is consistent with wording in Rule 2.5.1.3 'Taking primary samples'.

2.5.1.5: Revision to clarify procedures for obtaining submitted samples for moisture testing; proposal discussed by BSC and approved by vote.

2.5.1.6: 'Packing' added to heading. Many seed companies have ISTA accredited laboratories, where the warehouse in which the samples are taken and the testing laboratory are on the same premises, making it superfluous to seal the sample if the ISTA Sampler delivers it personally to the laboratory. The former wording was not consistent with 2.5.4.3, which already makes provision for this. Proposal discussed by BSC and approved by vote.

2.5.2.2, 2.5.2.2.1d and e: For variable and rotary dividers it is not necessary to mix the composite sample before dividing, as mixing of the seed takes place during the dividing process (stated in the *ISTA Sampling Handbook*). In the Rules it is required that 'the seed sample must first be thoroughly mixed' and the auditors apply this strictly, also for variable and rotary dividers. The exclusion of the pre-mixing requirement of these two dividers is now included in the Rules. Proposal discussed by the BSC and approved by vote.

2.5.2.2: Two paragraphs deleted. The first paragraph has been moved to 2.5.1.5 as it is more applicable to obtaining a submitted sample (for moisture) than it is for sample reduction methods. The deletion of the second paragraph is for consistency. Obtaining working samples for specific tests is generally specified in the applicable Chapters. This paragraph was a duplication of what is already stated in 9.2.5.2. Proposal was discussed by BSC and approved by vote.

2.5.2.2.3: Revision requested by BSC for readability and to remove the part that the spoon method is the recommended method for seed health testing. Proposal discussed by BSC and approved by vote.

2.5.4.2.1: *Festuca trachyphylla* was erroneously omitted from the Species group 2 list some years ago. It was part of the experiment and should be included.

2.5.4.4: Editorial change requested by BSC to correct erroneous reference; approved by BSC by vote.

Table 2C (formerly 2A): Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

Table 2C (formerly 2A) Part 3: Lot sizes and sample sizes moved from Table 2C (formerly 2A) Part 2 to Part 3 for *Malva sylvestris*, as this is not a woody species.

Table 2C (formerly 2A) Part 3: Inclusion of *Salvia hispanica* L. to the ISTA Rules; proposed sample and maximum seed lot size submitted to BSC by Purity Committee based on thousand-seed weight determinations. Discussed by the members of BSC and approved by vote.

Chapter 3

3.2.3: Editorial change required due to species in Taxodiaceae being absorbed into Cupressaceae. Corrections approved by Nomenclature Committee.

Table 3B Parts 1 and 2: Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

Chapter 4

Throughout Chapter, *Phelipanche* added where *Orobanche* is mentioned, with the assumption that the *Orobanche/Phelipanche* species concerned are parasitic plants with small dust-like seeds.

Chapter 5

5.6.4: Precision added relating to the extension of the duration of the germination test, and adapting the date of the final count when it ends on a non-working day.

5.9: It was no longer obvious why the % of normal seedlings obtained at the end of the test period, when the test is extended, must be reported. This prescription has been removed from the Rules.

Table 5A: Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

Table 5A Part 1: GA₃ is indicated as a dormancy breaking treatment for *Avena sativa* in section 5.6.3.1, and now added to Table 5A for this species, to achieve greater concordance and understanding.

Table 5A Part 1: Organic growing media added as a primary media for the germination of *Glycine max*.

Proposal supported by a validation study done within the Germination Committee.

Table 5A Part 1: Organic growing media added as a primary media for the germination of *Phaseolus vulgaris*. Proposal supported by a validation study done within the Germination Committee.

Table 5A Part 1: The Germination Committee has conducted a validation study on *Zea mays* to compare the results obtained with TP method using CCP, to the results obtained with the other ISTA approved substrates.

Table 5A Part 3: Germination method moved from Table 5A Part 2 to Part 3 for *Malva sylvestris*, as this is not a woody species.

Table 5A Part 3: Germination methods for *Salvia hispanica* included in the Rules, following validation studies carried out within the Germination Committee.

Chapter 6

Table 6A: Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

Chapter 7

Table 7A: Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

Method 7-019a: Addition of *Xanthomas campestris* pv. *raphani* in the plating assay as the pathovars are undistinguishable on the semi-selective media used. Inclusion of a process flow diagram in Background section to reflect optional and mandatory steps in the method. Proposal approved by a vote of Seed Health TCOM and supported by the Committee.

Method 7-025: Improvements to the description of the method and detailed descriptions of nematode identification. Figure added to assist in nematode identification. Proposal approved by vote and supported by Seed Health Committee.

Chapter 8

8.5.3: Editorial change required due to an incorrect cross reference to performance approved methods; corrections approved by Variety Committee.

Chapter 9

9.2.4.2: Changes to wording for oven requirements, to avoid specifying ‘ventilation’ and ‘capacity’ of the oven. The need to check whether the oven is fit for purpose or not is highlighted and text has been revised for readability. Proposal approved by Moisture Committee.

9.2.4.4: Adding additional possibilities to desiccator, such as perforated porcelain or other material instead of metal. Proposal approved by Moisture Committee.

9.2.5.1: References corrected and optimised where needed; an additional reference is added, and it is stressed that the correct sample size shall be used and where to find it. Proposal approved by Moisture Committee.

9.2.5.1, 9.2.5.2, 9.2.5.4 and 9.2.5.5: Changes to time limits for drawing working samples; time limits are given for mixing, grinding, cutting and drawing the working sample separately. Proposal approved by Moisture Committee.

Table 9A: Updates to nomenclature as a result of changes to the *ISTA List of Stabilised Plant Names*.

9.3.2.4.1: Addition of requirement for storing the remainder of the submitted sample for moisture using moisture meters; addition of the same requirement to storing time as for the submitted sample using the oven method. Proposal approved by Moisture Committee.

Chapter 15

15.3 and Table 15B: Addition of *Triticum aestivum* to the radicle emergence (RE) test, following a method validation study illustrating that the test identifies differences in vigour (field emergence) of seed lots of this species and is repeatable and reproducible.

15.8.4.4.1: Removal of requirement for a control seed lot for the radicle emergence (RE) test. Following their experience with the test, the Vigour Committee believes that when the test is completed following the prescribed ISTA Rules protocol, the use of a control seed lot is not necessary.

Chapter 18

18.8: Editorial change to 'Reporting results'. As a general principle, any statement of the applicant may be reported only in the space reserved for applicant statements/declarations. This space is reserved at the top of the ISTA certificate under 'Stated by applicant'. Therefore, the components of seed mixtures as reported by the applicant cannot be reported under 'Analysis results' as this space is reserved for laboratory results obtained by an ISTA laboratory through seed testing.

18.8.1: Clarification on how to report purity content of seed mixtures (i.e. the percentage by weight of pure seed, inert matter, and other seeds).

Chapter 7: Seed health testing

7.1 Object

The object of a seed health test is to determine the health status of a seed sample, and by inference that of the seed lot.

Health testing of seed is important for four reasons:

- a. Seed-borne inoculum may give rise to progressive disease development in the field and reduce the commercial value of the crop.
- b. Imported seed lots may introduce diseases into new regions. Tests to meet quarantine requirements may therefore be necessary.
- c. Seed health testing may elucidate seedling evaluation and causes of poor germination or field establishment and thus supplement germination testing.
- d. Seed health test results can/may indicate the necessity to carry out/perform seed lot treatment(s) in order to eradicate seed-borne pathogens or to reduce the risk of disease transmission.

7.2 Definitions

7.2.1 Seed health

Health of seed refers primarily to the presence or absence of disease-causing organisms, such as fungi, bacteria and viruses, and animal pests, including nematodes and insects, but physiological conditions such as trace element deficiency may be involved.

7.2.2 Pretreatment

Any physical or chemical laboratory treatment of the working sample preceding incubation, given solely to facilitate testing.

7.2.3 Seed treatment

See 2.2.12. For seed health testing, a seed lot may be treated for the purpose of controlling plant pathogens or insect pests, or correcting trace element deficiencies.

7.2.4 ISTA Seed Health Method Validation Programme

Before publication in the *International Rules for Seed Testing*, the ISTA seed health testing methods (new or equivalent) are validated. The principles and factors which should be considered in the validation of methods for the detection of seed-borne pathogens are described in the *ISTA Technical Guidelines for Organising and Analysing Results of Proficiency Tests (PT) and Interlaboratory Tests for Validation of Methods (CT)*.

7.3 General principles

Seed health testing should be performed using methods and equipment which have been tested to ensure they are fit for purpose. Different methods of testing are available, varying in sensitivity and reproducibility and in the amount of training and equipment required. The method used will depend on the pathogen or condition to be investigated, the species of the seed, and the purpose of the test. Selection of the method and evaluation of the results requires knowledge and experience of the methods available. The presence or absence of disease organisms, pests and deleterious physiological conditions specified by the sender is estimated as accurately as the method used permits.

7.4 Procedures

7.4.1 Working sample

The entire submitted sample, or a proportion of it, depending on the test method, may be used as a working sample. The sample should be packaged and submitted in a manner which will not alter its seed health status.

Exceptionally, a submitted sample larger than that prescribed in 2.8 may be required and in such cases the sampler must be instructed accordingly.

When a portion of the submitted sample is required as a working sample, the reduction must be carried out in accordance with 2.5.2, taking appropriate precautions to avoid cross-contamination.

Normally the working sample must not be less than that specified in the method description.

Replicates containing a specified number of seeds, if required, must be taken at random from a subsample after thorough mixing.

7.4.2 Seed treatment

Test results may be influenced by treatment applied to the seed lot. Seed health tests on treated seeds will generally deliver unreliable test results caused by masking or inhibition of the growth of the target organism. Individual Method Sheets will determine whether the testing of treated seeds is acceptable.

7.4.3 Sample storage

The microflora of seed, in the lot or the sample, may change considerably during storage in conditions in which seed viability is satisfactorily maintained. The selection of the appropriate storage conditions must take into account the optimal storage temperature and container in order to maintain sample integrity.

Abundant development of saprophytic moulds including ‘storage fungi’ in tests can be an indication that the seed is not of good quality due to unfavourable harvesting, processing or storage conditions, or to ageing. Some fungi (such as *Rhizopus* spp.) spread rapidly over tests on blotters and may rot originally healthy seedlings or may interfere with outgrowth of the pathogen from the plated infected seeds. Pretreatment as described in the specific method may be advisable.

7.4.4 Specific directions

Specific seed health testing methods are published online on the ISTA web site at:

www.seedtest.org/seedhealthmethods

Seed health methods are normally based on one host, and one pathogen, but multi-pathogen methods may be

included. Before publication, all seed health test methods must be validated through the ISTA Seed Health Method Validation Programme. Methods validated in this way at the time of printing are listed in Table 7A. Additions, updates and deletions to this list can be found on the ISTA web site (www.seedtest.org/seedhealthmethods). The definitive list is held by the ISTA Secretariat. It is the responsibility of the laboratory using the method to consult this list.

7.5 Calculation and expression of results

Results are expressed either qualitatively or quantitatively as specified in the individual prescribed methods.

7.6 Reporting results

The results of a test for seed health must be reported under ‘Other determinations’ as follows:

- either qualitative or quantitative results, as specified in the individual methods;
- negative and positive results, as specified in the individual methods;
- the scientific name of the pathogen detected;
- the percentage of infected seeds;
- the method used, including any pretreatment (7.2.2);
- the size of the sample or fraction examined;
- any additional permitted procedure used.

The absence of a statement concerning the health condition of the seed does not necessarily imply that the health condition is satisfactory.

Table 7A. ISTA official seed health testing methods

7-001a: Detection of *Alternaria dauci* in *Daucus carota* (carrot) seed by blotter method

Host: *Daucus carota* L.

Pathogen(s): *Alternaria dauci* (J.G.Kühn) J.J.Groves & Skolko, syn. *A. porri* f.sp. *dauci* (J.G.Kühn) Neerg., syn. *A. carotae* (Ellis & Langlois) Stevenson & Wellman

Date approved: 2012

Review due: 2017

7-001b: Detection of *Alternaria dauci* in *Daucus carota* (carrot) seed by malt agar method

Host: *Daucus carota* L.

Pathogen(s): *Alternaria dauci* (J.G.Kühn) J.J.Groves & Skolko, syn. *A. porri* f.sp. *dauci* (J.G.Kühn) Neerg., syn. *A. carotae* (Ellis & Langlois) Stevenson & Wellman

Date approved: 2012

Review due: 2017

7-002a: Detection of *Alternaria radicina* in *Daucus carota* (carrot) seed by blotter method

Host: *Daucus carota* L.

Pathogen(s): *Alternaria radicina* Meier, Drechsler & E.D.Eddy, syn. *Stemphylium radicinum* (Meier, Drechsler & E.D.Eddy) Neergaard

Date approved: 2012

Review due: 2017

7-002b: Detection of *Alternaria radicina* in *Daucus carota* (carrot) seed by malt agar method

Host: *Daucus carota* L.

Pathogen(s): *Alternaria radicina* Meier, Drechsler & E.D.Eddy, syn. *Stemphylium radicinum* (Meier, Drechsler & E.D.Eddy) Neergaard

Date approved: 2012

Review due: 2017

7-003: Detection of *Botrytis cinerea* in *Helianthus annuus* (sunflower) seed

Host: *Helianthus annuus* L.

Pathogen(s): *Botrytis cinerea* Pers. ex Pers. (Perfect state *Botryotinia fuckeliana* (de Bary) Whetzel, syn. *Sclerotinia fuckeliana* (de Bary) Fuckel.)

Date approved: 2011

Review due: 2016

7-004: Detection of *Leptosphaeria maculans* and *Plenodomus biglobosus* in *Brassica* spp. seed

Host: *Brassica* spp.

Pathogen(s): *Leptosphaeria maculans* (Tode ex Fr.) Ces. & de Not (previously *Phoma lingam*) or *Plenodomus biglobosus* (Shoemaker & H. Brun) (previously *Leptosphaeria biglobosa*)

Date approved: 2017

Review due: 2022

7-005: Detection of *Ascochyta pisi* in *Pisum sativum* (pea) seed

Host: *Pisum sativum* L.s.l.

Pathogen(s): *Ascochyta pisi* Lib.

Date approved: 2011

Review due: 2016

7-006: Detection of *Colletotrichum lindemuthianum* in *Phaseolus vulgaris* (bean) seed

Host: *Phaseolus vulgaris* L.

Pathogen(s): *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cav.

Date approved: 2011

Review due: 2016

7-007: Detection of *Alternaria linicola*, *Botrytis cinerea* and *Colletotrichum lini* in *Linum usitatissimum* (flax, linseed) seed

Host: *Linum usitatissimum* L.

Pathogen(s): *Alternaria linicola* J.W.Groves & Skolko; *Botrytis cinerea* Pers. ex Pers. (Perfect state *Botryotinia fuckeliana* (de Bary) Whetzel, syn. *Sclerotinia fuckeliana* (de Bary) Fuckel.); *Colletotrichum lini* (Westerd.) Tochinai, syn. *C. linicola* Pethybr. & Laff.

Date approved: 2012

Review due: 2017

7-008: Detection of *Caloscypha fulgens* in *Picea engelmannii* and *P. glauca* (spruce) seed

Host: *Picea engelmannii* Engelm.; *Picea glauca* (Moench) Voss

Pathogen(s): *Caloscypha fulgens* (Pers.) Boud. (Imperfect state *Geniculodendron pyriforme* Salt)

Date approved: 2011

Review due: 2016



Table 7A. ISTA official seed health testing methods (cont.)

7-009: Detection of *Fusarium circinatum* in *Pinus* spp. (pine) and *Pseudotsuga menziesii* (Douglas fir) seed
Host: *Pinus* spp.; *Pseudotsuga menziesii* (Mirb.) Franco
Pathogen(s): *Fusarium circinatum* Nirenberg & O'Donnell (syn. *Fusarium subglutinans* f. sp. *pini* Hepting, syn. *Fusarium lateritium* f. sp. *pini* Hepting, syn. *Gibberella circinata*)
Date approved: 2018
Review due: 2023

7-010: Detection of *Bipolaris oryzae* in *Oryza sativa* (rice) seed
Host: *Oryza sativa* L.
Pathogen(s): *Bipolaris oryzae* (Breda de Haan) Shoem., syn. *Drechslera oryzae*, syn. *Helminthosporium oryzae* Breda de Haan (Perfect state *Cochliobolus miyabeanus* (Ito & Kurib.) Drechsler ex Dastur, syn. *Ophiobolus miyabeanus* Ito & Kuribayashi)
Date approved: 2018
Review due: 2023

7-011: Detection of *Pyricularia oryzae* in *Oryza sativa* (rice) seed
Host: *Oryza sativa* L.
Pathogen(s): *Magnaporthe grisea* (Hebert) Barr (Imperfect state *Pyricularia oryzae* Cavara, syn. *P. grisea*)
Date approved: 2011
Review due: 2016

7-012: Detection of *Trichoconiella padwickii* in *Oryza sativa* (rice) seed
Host: *Oryza sativa* L.
Pathogen(s): *Trichoconiella padwickii* Ganguly, syn. *Alternaria padwickii* (Ganguly) Jain
Date approved: 2018
Review due: 2023

7-013a: Detection of *Ustilago nuda* in *Hordeum vulgare* subsp. *vulgare* (barley) seed by embryo extraction
Host: *Hordeum vulgare* L. subsp. *vulgare*
Pathogen(s): *Ustilago nuda* (Jens.) Rostr.
Date approved: 2011
Review due: 2016

7-013b: Detection of *Ustilago nuda* in *Hordeum vulgare* subsp. *vulgare* (barley) seed by dehulling and embryo extraction
Host: *Hordeum vulgare* L. subsp. *vulgare*
Pathogen(s): *Ustilago nuda* (Jens.) Rostr.
Date approved: 2011
Review due: 2016

7-014: Detection of *Parastagonospora nodorum* in *Triticum aestivum* subsp. *aestivum* (wheat) seed
Host: *Triticum aestivum* L. subsp. *aestivum*
Pathogen(s): *Parastagonospora nodorum* (Berk.) Quaedvl., Verkley & Crous 2013, syn. *Stagonospora nodorum*, syn. *Septoria nodorum* Berk. (Perfect state *Leptosphaeria nodorum* Mailer)
Date approved: 2018
Review due: 2023

7-015: Detection of *Epichloë coenophiala* in *Festuca* spp. (fescue) and of *Neotyphodium lolii* in *Lolium* spp. (ryegrass) seed
Host: *Festuca* spp., *Lolium* spp.
Pathogen(s): *Epichloë coenophiala* (Morgan-Jones & W. Gams) C.W. Bacon & Schardl; *Neotyphodium lolii* (Latch, M.J.Chr. & Samuels) Glenn, C.W.Bacon & Hanlin
Date approved: 2017
Review due: 2022

7-016: Detection of *Phomopsis* complex in *Glycine max* (soybean, soya bean) seed
Host: *Glycine max* (L.) Merr.
Pathogen(s): *Phomopsis longicolla* Hobbs, *Diaporthe phaseolorum* var. *sojae* (Lehm.) Wehm. (Imperfect state *P. phaseoli* (Desm.) Sacc., syn. *P. sojae* Lehmann); *Diaporthe phaseolorum* (Cke. & Ell.) Sacc. f. sp. *caulivora* (DPC), syn. *D. phaseolorum* var. *caulivora* Athow & Caldwell
Date approved: 2012
Review due: 2017

7-017: (Replaced by 7-007)

7-018: (Replaced by 7-007)

7-019a: Detection of *Xanthomonas campestris* pv. *campestris* and *Xanthomonas campestris* pv. *raphani* in *Brassica* spp. seed
Host: *Brassica* spp.
Pathogen(s): *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson and *Xanthomonas campestris* pv. *raphani*
Date approved: 2019
Review due: 2024

7-019b: Detection of *Xanthomonas campestris* pv. *campestris* in disinfested/disinfected *Brassica* spp. seed
Host: *Brassica* spp.
Pathogen(s): *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson
Date approved: 2018
Review due: 2023

Table 7A. ISTA official seed health testing methods (cont.)

7-020: Detection of *Xanthomonas hortorum* pv. *carotae* in *Daucus carota* (carrot) seed

Host: *Daucus carota* L.

Pathogen(s): *Xanthomonas hortorum* pv. *carotae* (Kendrick) Vauterin, Hoste, Kersters & Swings, syn. *X. campestris* pv. *carotae* (Kend) Dye

Date approved: 2010

Review due: 2015

7-021: Detection of *Xanthomonas axonopodis* pv. *phaseoli* and *X. axonopodis* pv. *phaseoli* var. *fuscans* in *Phaseolus vulgaris* (bean) seed

Host: *Phaseolus vulgaris* L.

Pathogen(s): *Xanthomonas axonopodis* pv. *phaseoli* (Smith) Vauterin, Hoste, Kersters & Swings, syn. *X. campestris* pv. *phaseoli* (Smith) Dye; *Xanthomonas axonopodis* pv. *phaseoli* var. *fuscans* Vauterin, Hoste, Kersters & Swings, syn. *X. campestris* pv. *phaseoli* var. *fuscans* (Burkholder) Starr & Burkholder

Date approved: 2011

Review due: 2016

7-022: Detection of *Microdochium nivale* and *M. majus* in *Triticum* spp. (wheat) seed

Host: *Triticum* spp.

Pathogen(s): *Microdochium nivale* Samuels & Hallett, syn. *Fusarium nivale* (Fr.) Rabenh. (Perfect state *Monographella nivalis* (Schaff.) Müller); *M. majus* (Wollenw.) Glynn & S.G. Edwards, syn. *M. nivale* var. *majus* (Wollenw.) Samuels & I.C. Hallett

Date approved: 2018

Review due: 2023

7-023: Detection of *Pseudomonas savastanoi* pv. *phaseolicola* in *Phaseolus vulgaris* (bean) seed

Host: *Phaseolus vulgaris* L.

Pathogen(s): *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan, Bollet, Abu, Ghorrah, Grimont & Grimont, syn. *P. syringae* pv. *phaseolicola* (Burkh.) Young, Dye & Wilkie

Date approved: 2012

Review due: 2017

7-024: Detection of *pea early browning virus* and *pea seed-borne mosaic virus* in *Pisum sativum* (pea) seed

Host: *Pisum sativum* L.s.l.

Pathogen(s): *Pea early browning virus* (PEBV) and *pea seed-borne mosaic virus* (PSbMV)

Date approved: 2012

Review due: 2017

7-025: Detection of *Aphelenchoides besseyi* in *Oryza sativa* (rice) seed

Host: *Oryza sativa* L.

Pathogen(s): *Aphelenchoides besseyi* Christie

Date approved: 2019

Review due: 2024

7-026: Detection of *squash mosaic virus*, *cucumber green mottle mosaic virus* and *melon necrotic spot virus* in cucurbit seed

Host: Cucurbits

Pathogen(s): *Squash mosaic virus* (SqMV); *cucumber green mottle mosaic virus* (CGMMV); *melon necrotic spot virus* (MNSV)

Date approved: 2014

Review due: 2019

7-027: Detection of *Pyrenophora teres* and *P. graminea* in *Hordeum vulgare* subsp. *vulgare* (barley) seed

Host: *Hordeum vulgare* L. subsp. *vulgare*

Pathogen(s): *Pyrenophora teres* Drechsler (Imperfect state *Drechslera teres* (Sacc.) Shoem.); *Pyrenophora graminea* Ito & Kurib. (Imperfect state *D. graminea* (Rabenh. Ex Schlecht.) Shoem.)

Date approved: 2011

Review due: 2016

7-028: Detection of infectious *tobacco mosaic virus* and *tomato mosaic virus* in *Solanum lycopersicum* (tomato) seed by the local lesion assay (indexing) in *Nicotiana tabacum* plants

Host: *Solanum lycopersicum* L.

Pathogen(s): *Tobacco mosaic virus* (TMV); *tomato mosaic virus* (ToMV)

Date approved: 2012

Review due: 2017

7-029: Detection of *Pseudomonas syringae* pv. *pisi* in *Pisum sativum* (pea) seed

Host: *Pisum sativum* L.s.l.

Pathogen(s): *Pseudomonas syringae* pv. *pisi* (Sack.) Young, Dye & Wilkie

Date approved: 2012

Review due: 2017

7-030: Detection of *Acidovorax valerianellae* in *Valerianella locusta* (corn salad) seed

Host: *Valerianella locusta* (L.) Laterr.

Pathogen(s): *Acidovorax valerianellae* sp. nov.

Date approved: 2014

Review due: 2019



Table 7A. ISTA official seed health testing methods (cont.)

7-031: Filtration method for detection of *Ditylenchus dipsaci* in *Medicago sativa*; *D. dipsaci* and *D. gigas* in *Vicia faba*

Host: *Medicago sativa* L. and *Vicia faba* L.

Pathogen(s): *Ditylenchus dipsaci* Kuhn, 1857;
Ditylenchus gigas n. sp.

Date approved: 2017

Review due: 2022

7-032: Detection of *Verticillium dahliae* in *Spinacia oleracea* (spinach) seed

Host: *Spinacia oleracea* L.

Pathogen(s): *Verticillium dahliae* Kleb.

Date approved: 2017

Review due: 2022