Chapter 7: Seed health testing

Including changes and editorial corrections adopted at the Ordinary General Meeting 2023 in Verona, Italy

Effective from 1 January 2024
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 2024 edition of the ISTA Rules

Since 2014, the International Rules for Seed Testing (ISTA Rules) are primarily available in electronic format. The ISTA Rules can be downloaded as a complete PDF file or as individual chapters from:
  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:
  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 Annexe to Chapter 7 of the ISTA Rules. They are now available as separate method sheets from the ISTA website at:
  www.seedtest.org/seedhealthmethods.

Details of changes

The 2024 changes are editorial corrections or Rules changes adopted at the Ordinary General Meeting held in Verona, Italy in June 2023. 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 with yellow highlight boxes as a ‘layer’ over the English version 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 2023 on the ISTA website.

  Ernest Allen, ISTA Rules Committee Chair
  Susan Alvarez, ISTA Rules Committee Vice-Chair
  ISTA Secretariat

Effective 1 January 2024
Changes to the ISTA Rules for 2024

Introduction

1-1: New address for ISTA Secretariat updated.
1-2: Standard method provided to determine working weight of purity and other seed determination (OSD) for adding a new taxon [taxa] to Table 2C, including data rounding rules. Statistical methods applied and experimental design recommended in the Calculator developed by Statistics TCOM. Proposal submitted by Bulking & Sampling and Purity TCOMs, and approved by majority vote.

Form 1: Revision of form to improve procedures and guidance for proposing a new taxon to Table 2C. Section 2 updated with newly developed ‘Calculator for adding working weights to Table 2C’. Section 3 revised to clarify purpose of providing morphological features for PSD (not for identification). New section 4 added to provide validated working weight for a new taxon or group of taxa. Proposal approved by Purity TCOM through vote.

Chapter 1

1.3: Revision of maximum sublot size allowance for Solanum lycopersicum L. Proposal supported by experimental data, a summary report and analysis supplied by Statistics TCOM. Recommendation that a maximum of 20 sublots should be set for homogeneous seed lots of tomato, accounting for a low level of other seed content. This would assure buyers and sellers that test results represent what is traded, and provides a practical solution for companies producing tomato seed lots. Proposal approved by Statistics TCOM and unanimous vote of Bulking & Sampling TCOM and ECOM-VSI WG.

1.4: Revision to allow weight of original seed lot and weight of sublot to be recorded in same place on ISTA Certificate. Proposal approved by Statistics TCOM and unanimous vote of Bulking & Sampling TCOM and ECOM-VSI WG.

1.5: Consequential change due to update to sections of Chapter 11, reflecting advancements in available seed treatments. Clarifications added on how and what to report when testing coated seeds. Proposal approved by majority vote of Purity TCOM.

1.5.2.3: Consequential change due to improvements made to germination information in Chapter 11, rewording general principles, evaluation and reporting results. Proposal originates from and is supported by Germination TCOM.

1.5.2.12: Clarification on reporting moisture tests for pelleted seeds and for coated seeds (mats and tapes), to align with Chapter 11. Proposal originates from and is supported by Moisture TCOM.

1.5.2.15: Consequential change due to improvements made to germination information in Chapter 13, rewording calculation and expression of results, and reporting results. Proposal originates from and is supported by Germination TCOM, following consultation with Forest Tree and Shrub Seed TCOM.

1.5.2.16: Consequential change due to revision and updating of Chapter 14 to improve clarity. Previous information obsolete due to new generations of X-ray machines and applications of digital technology. Significant changes are focused on equipment and its operation, as well as clarification on reporting. Proposal developed and approved by Advanced Technologies, Forest Tree & Shrub Seed and Purity TCOMs.

1.5.2.21: Section updated to reflect changes on how to report results of GMO testing in 19.7.

1.5.3: Change necessary to achieve consistency with 19.7 in reporting uncertainty of measurement when testing genetically modified organisms. Proposal approved by vote within GMO TCOM.

Chapter 2

2.2: Revision of maximum sublot size allowance for Solanum lycopersicum L. Proposal supported by experimental data, a summary report and analysis supplied by Statistics TCOM. Recommendation that a maximum of 20 sublots should be set for homogenous seed lots of tomato, accounting for a low level of other seed content. This would assure buyers and sellers that test results represent what is traded, and provides a practical solution for companies producing tomato seed lots. Proposal approved by Statistics TCOM and unanimous vote of Bulking & Sampling TCOM and ECOM-VSI WG.
2.5.2.1: Revision to provide standard method to determine working weight of purity and other seed determination (OSD) for adding new weights to Table 2C, including data rounding rules. Working weight determinations developed based on statistically recognised methods for estimating variables such as lots, variety and testing laboratories, and removing data outliers. Proposal provided by Bulking & Sampling and Purity TCOMs, and approved by majority vote. Statistical methods applied and experimental design recommended in the Calculator were developed by Statistics TCOM.

Table 2C Part 1: Revision following survey of ISF members producing tomato seed lots, concluding that 200 kg is a maximum lot size for international trade in tomato seed. Proposal discussed in depth within Bulking & Sampling TCOM, approved by Statistics TCOM, and approved by close majority vote of Bulking & Sampling TCOM and ECOM-VSI WG.

Chapter 3

3.5.2.4: Clarification regarding identification of indistinguishable species. Procedures only apply when seed is deemed by laboratories as ‘indistinguishable’, with discretion. Proposal supported by majority vote of Purity TCOM.

3.7: Correction of inconsistency with requirements in 3.6.1.3, as identified by an ISTA member laboratory. Proposal submitted by Purity TCOM and approved by vote.

Table 3B Part 2: Definition of PSD 15 made more inclusive for species where schizocarp could be broken and present in a sample. Schizocarp more than one-half original size is added. Proposal developed and approved by Purity TCOM.

Table 3B Part 2: Revision to correct discrepancy between PSD 33 (Fig. 3.1) and the ISTA Handbook on Pure Seed Definitions (Fig. 33.1), including multiple seed units with both fertile and sterile florets. Proposal developed and approved by Purity TCOM.

Chapter 4

4.5.3.2, 4.6, 4.7, 4.8, Table 4B [newly named], Table 4B [newly named]: Clarification on reporting sample weight of determination of other seeds to a fixed decimal place. Misleading use of ‘minimum’ deleted. Table given caption, subsequent tables renamed and cross references updated. Proposal developed and approved by Purity TCOM.

Chapter 5

5.6.3.1, 5.6.5.3, 5.7: Revision of rules on retesting when fresh seed present. Purpose of proposal is to address issue of considering test results of initial germination test ‘unsatisfactory’ and instruction to not report these test results and to require a retest when dormancy is suspected. Laboratories should have option to either report % germination and % fresh seeds determined by the initial test, or to not report results of initial test and to conduct additional testing using dormancy-breaking procedures listed in Table 5A. When fuller assessment is requested by customer or desired by laboratory, test results are not reported and a retest would be conducted. ISTA Rules should allow for same testing and reporting option for ‘fresh seeds’ as for ‘hard seeds’ (5.6.3.2). At end of test period, if ungerminated seeds are determined to be ‘fresh’, % fresh seeds is reported. Proposal originates from and is supported by Germination TCOM.

5.10: Editorial change clarifying column to be checked in Table 5A Part 2 for ‘double tests’.

Table 5A Part 1: Editorial change to correct alphabetical order of two Centrosema species.

Chapter 6

Table 6A Part 2: Addition of method to test Ulmus spp. seeds with tetrazolium salts. Proposal approved by Tetrazolium TCOM and supported by method validation study.

Chapter 7

All seed health methods: Sample size description revised for consistency across methods.

Methods 7-001a, 7001b, 7-002a, 7-002b, 7-003, 7-005, 7-007, 7-013a, 7-014, 7-016: Figure images updated and captions revised.

Method 7-013b: Figure and caption added.

Methods 7-019a, 7-019b, 7-020, 7-021, 7-023: Editorial changes to harmonise description of dilutions under Methods.

Methods 7-019a, 7-019b, 7-020, 7-021, 7-023, 7-029: Editorial changes to harmonise description of recording colony-forming units (cfu).

Method 7-019b: Editorial change to delete X. c. pv. amoracae from classification of Xanthomonas.
Chapter 9

9.2.4.7, 9.2.5.1, 9.2.5.2, 9.2.5.3, 9.2.5.4, 9.2.5.5, 9.2.5.6, 9.2.5.7, 9.2.6.2: Updating of cross reference to Table 9A. Parts 1 and 2 of Table 9A merged due to changes in crop groups, to allow easier inclusions and modifications in future. Some species renamed according to Table 2C and additional information included for species new to taxonomy. Proposal originates from and is supported by Moisture TCOM.

9.2.5.7: Prescribed drying temperatures explicitly given, as in 9.1.2 and 9.1.3. Proposed tolerated range for high temperature method (127–133 °C) aligns with that prescribed by AOSA. Comparison conducted in two laboratories; Statistics TCOM analysed data and supports proposed change. Proposal originates from and is supported by Moisture TCOM.

9.2.6.2, Table 9B: Deletion of word ‘initial’ before ‘moisture content’. Proposal originates from and is supported by Moisture TCOM.

9.2.7: Clarification on reporting moisture tests for pelleted seeds and for coated seeds (mats and tapes), to align with Chapter 11. Proposal originates from and is supported by Moisture TCOM.

Table 9A: Parts 1 and 2 of Table 9A merged due to changes in crop groups (e.g. Malva transferred from tree & shrub to flower crop group), to allow easier inclusions and modifications in future. Some species renamed according to Table 2C and additional information included for species new to taxonomy. Proposal originates from and is supported by Moisture TCOM.

Chapter 11

11.1.2 [newly numbered], 11.3.2.2, 11.3.7, 11.10: Update to sections of Chapter 11 to reflect advancements in available seed treatments. Cross references to recent changes in Chapter 10 included. Clarifications added on how and what to report when testing coated seeds. Proposal approved by majority vote of Purity TCOM.

11.4.6: Cross reference to Table 4A updated due to relabelling of tables in Chapter 4.

11.5.3, 11.5.6.5, 11.5.8: Improvements made to germination information in Chapter 11 by rewriting general principles, evaluation and reporting results. Proposal originates from and is supported by Germination TCOM.

Chapter 13

13.7: Improvements made to germination information in Chapter 13 by rewriting calculation and expression of results, and reporting results. Proposal originates from and is supported by Germination TCOM, following consultation with Forest Tree and Shrub Seed TCOM.

Chapter 14

Revision and updating of chapter to improve clarity. Previous information obsolete due to new generations of X-ray machines and applications of digital technology. Significant changes are focused on equipment and its operation, as well as clarification on reporting. Proposal developed and approved by Advanced Technologies, Forest Tree & Shrub Seed and Purity TCOS.

Chapter 18

18.8: Addition of section regarding reporting moisture content of seed mixtures. Subsequent sections in chapter renumbered and cross references updated. Proposal originates from and is supported by Moisture TCOM.
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.
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. pori f.sp. dauci (J.G. Kühn) Neerg., syn. A. carotae (Ellis & Langlois) Stevenson & Wellman
Date approved: 2024
Review due: 2029

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. pori f.sp. dauci (J.G. Kühn) Neerg., syn. A. carotae (Ellis & Langlois) Stevenson & Wellman
Date approved: 2024
Review due: 2029

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: 2024
Review due: 2029

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: 2024
Review due: 2029

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: 2024
Review due: 2029

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: 2024
Review due: 2029

7-005: Detection of Ascochyta pisi in Pisum sativum (pea) seed
Host: Pisum sativum L.s.l.
Pathogen(s): Ascochyta pisi Lib.
Date approved: 2024
Review due: 2029

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: 2024
Review due: 2029

7-007: Detection of Alternaria linicola, Botrytis cinerea and Colletotrichum lini in Linum usitatissimum (flax, linseed) seed
Host: Linum usitatissimum L.
Date approved: 2024
Review due: 2029

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 Geniculosclerodendron pyriforme Salt)
Date approved: 2024
Review due: 2029
Table 7A. ISTA official seed health testing methods (cont.)

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Method Description</th>
<th>Host</th>
<th>Pathogen(s)</th>
<th>Date approved</th>
<th>Review due</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-009</td>
<td>Detection of Fusarium circinatum 1n Pinus spp. (pine) and Pseudotsuga menziesii (Douglas fir) seed</td>
<td>Pinus spp.; Pseudotsuga menziesii (Mirb.) Franco</td>
<td>Fusarium circinatum Nirenberg &amp; O'Donnell (syn. Fusarium subglutinans f. sp. pini Hepting, syn. Fusarium lateritium f. sp. pini Hepting, syn. Gibberella circinata)</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-010</td>
<td>Detection of Bipolaris oryzae in Oryza sativa (rice) seed</td>
<td>Oryza sativa L.</td>
<td>Bipolaris oryzae (Breda de Haan) Shoem., syn. Drechslera oryzae, syn. Helminthosporium oryzae Breda de Haan (Perfect state Cochliobolus miyabeanus (Ito &amp; Kurib.) Drechsler ex Dastur, syn. Ophiobolus miyabeanus Ito &amp; Kuribayashi)</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-011</td>
<td>Detection of Pyricularia oryzae in Oryza sativa (rice) seed</td>
<td>Oryza sativa L.</td>
<td>Magnaporthe grisea (Hebert) Barr (Imperfect state Pyricularia oryzae Cavara, syn. P. grisea)</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-012</td>
<td>Detection of Trichoconiella padwickii in Oryza sativa (rice) seed</td>
<td>Oryza sativa L.</td>
<td>Trichoconiella padwickii Ganguly, syn. Alternaria padwickii (Ganguly) Jain</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-013a</td>
<td>Detection of Ustilago nuda in Hordeum vulgare subsp. vulgare (barley) seed by embryo extraction</td>
<td>Hordeum vulgare L. subsp. vulgare</td>
<td>Ustilago nuda (Jens.) Rostr.</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-013b</td>
<td>Detection of Ustilago nuda in Hordeum vulgare subsp. vulgare (barley) seed by dehulling and embryo extraction</td>
<td>Hordeum vulgare L. subsp. vulgare</td>
<td>Ustilago nuda (Jens.) Rostr.</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-014</td>
<td>Detection of Parastagonospora nodorum in Triticum aestivum subsp. aestivum (wheat) seed</td>
<td>Triticum aestivum L. subsp. aestivum</td>
<td>Parastagonospora nodorum (Berk.) Quaedvl., Verkley &amp; Crous 2013, syn. Stagonospora nodorum, syn. Septoria nodorum Berk. (Perfect state Leptosphaeria nodorum Mailer)</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-015</td>
<td>Detection of Epichloë coenophiala in Festuca spp. (fescue) and of Neotyphodium lolii in Lolium spp. (ryegrass) seed</td>
<td>Lolium spp.</td>
<td>Epichloë coenophiala (Morgan-Jones &amp; W. Gams) C.W. Bacon &amp; Schardl, Neotyphodium lolii (Latch, M.J.Chr. &amp; Samuels) Glenn, C.W.Bacon &amp; Hanlin</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-016</td>
<td>Detection of Phomopsis complex in Glycine max (soybean, soya bean) seed</td>
<td>Glycine max (L.) Merr.</td>
<td>Phomopsis longicolla Hobbs, Diaporthe phaseolorum var. sojae (Lehm.) Wehm. (Imperfect state P. phaseoli (Desm.) Sacc., syn. P. sojae Lehmann); Diaporthe phaseolorum (Cke. &amp; Ell.) Sacc. f. sp. caulivora (DPC), syn. D. phaseolorum var. caulivora Athow &amp; Caldwell</td>
<td>2024</td>
<td>2029</td>
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<tr>
<td>7-017</td>
<td>(Replaced by 7-007)</td>
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<tr>
<td>7-018</td>
<td>(Replaced by 7-007)</td>
<td></td>
<td></td>
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<tr>
<td>7-019a</td>
<td>Detection of Xanthomonas campestris pv. campestris and Xanthomonas campestris pv. raphani in Brassica spp. seed</td>
<td>Brassica spp.</td>
<td>Xanthomonas campestris pv. campestris (Pammel) Dowson and Xanthomonas campestris pv. raphani</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>7-019b</td>
<td>Detection of Xanthomonas campestris pv. campestris in disinfested/disinfected Brassica spp. seed</td>
<td>Brassica spp.</td>
<td>Xanthomonas campestris pv. campestris (Pammel) Dowson</td>
<td>2024</td>
<td>2029</td>
</tr>
</tbody>
</table>
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: 2024
Review due: 2029

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: 2024
Review due: 2029

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 
majus (Wollenw.) Samuels & I.C.Hallett
Date approved: 2024
Review due: 2029

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, Ghorrarah, Grimont & 
Grimont, syn. P. syringae pv. phaseolicola (Burkh.) Young, 
Dye & Wilkie
Date approved: 2024
Review due: 2029

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: 2024
Review due: 2029

7-025: Detection of Aphelenchoides besseyi in Oryza 
sativa (rice) seed 
Host: Oryza sativa L. 
Pathogen(s): Aphelenchoides besseyi Christie
Date approved: 2024
Review due: 2029

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: 2024
Review due: 2029

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: 2024
Review due: 2029

7-028: Detection of infectious tobacco mosaic virus and 
tobacco 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: 2024
Review due: 2029

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: 2024
Review due: 2029

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: 2024
Review due: 2029
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:** 2024  
**Review due:** 2029

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

**Host:** *Spinacia oleracea* L.  
**Pathogen(s):** *Verticillium dahliae* Kleb.

**Date approved:** 2024  
**Review due:** 2029