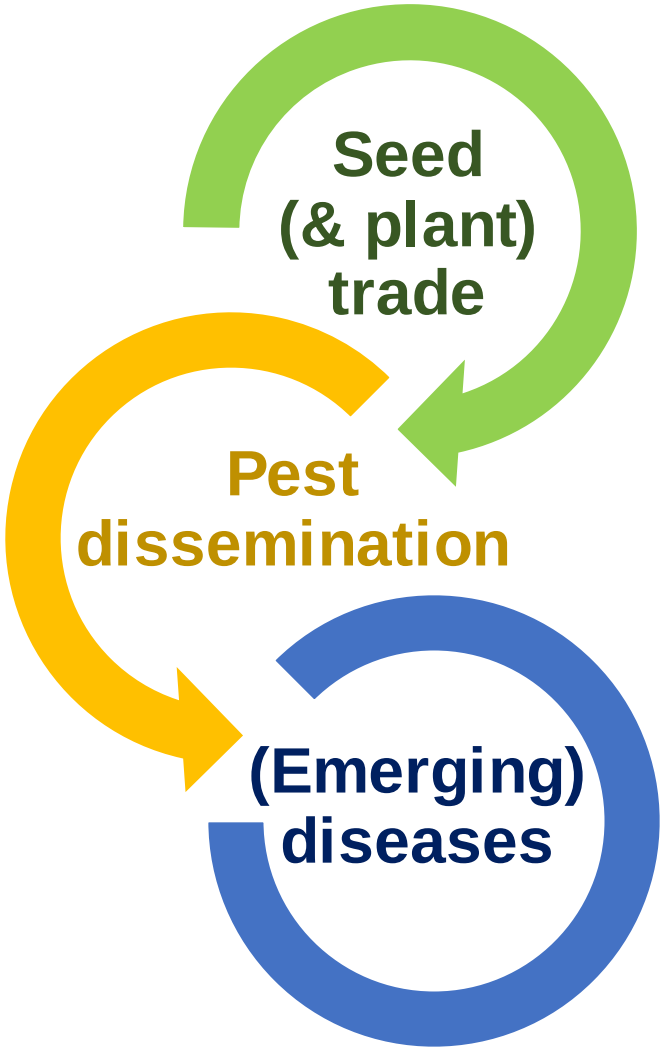
ISTA
100 YEARS
A CENTURY OF PROGRESS IN SEED QUALITY ASSURANCE

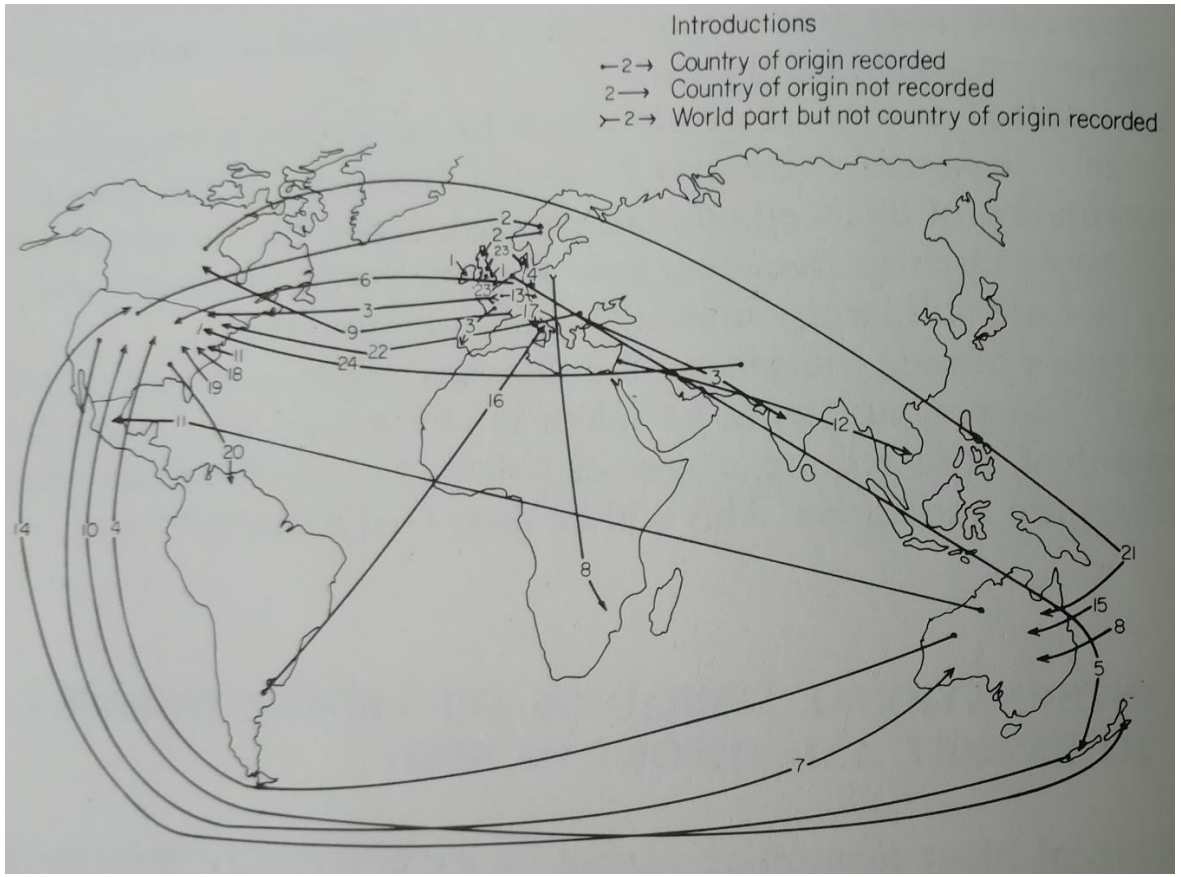
nak tuinbouw

The incredible world of seed pathology and how it's used to prevent the next plant pandemic!

Presentation by: Ruud Barnhoorn
Vegetable Seed Pathologist
ISTA Chair Seed Health Committee

Seed pests threaten food security





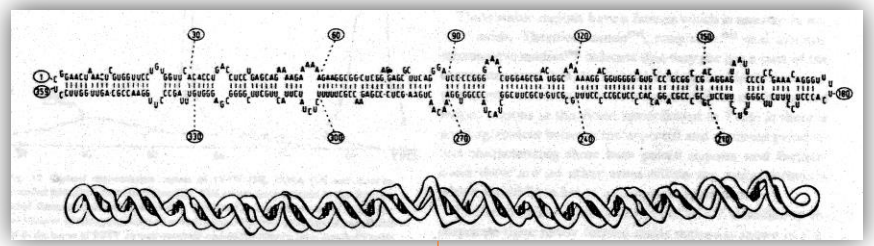
Introduction via infected seeds (1880s – 1970s)

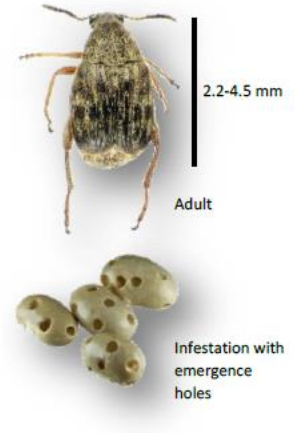
1. *Corynebacterium michiganense* (1942)
2. *Pseudomonas glycinea* (1940s)
3. *Xanthomonas campestris* (1961)
4. *Corynebacterium rathayi* (1945, 1965)
5. *Xanthomonas phaseoli* (1969)
6-8. *Puccinia sp.* (1885, 1906, 1940, 1952)
9. *Uromyces betae* (1943)
10. *Tilletia caries* (1854)
11. *Urocystis agropyri* (1919, 1946)
12. *Ustilago tritici* (1970)
13. *Urocystis cepulae* (1924)
14. *Gloeotinia temulenta* (1940)
15-17. *Peronospora sp.* (1881, 1922, 1935)
18. *Botrytis riini* (1926)
19. *Sclerotium oryzae* (1926)
20. *Gloeocercospora sorghi* (1949)
21. *Septoria linicola* (1948)
22. *Epichloë typhina* (1942)
23. *Barley stripe mosaic virus* (1959, 1972)
24. *Squash mosaic virus* (1964)
25. *Ascochyta rabei* (1973)

Pests transmitted by seeds

Viroïds

PSTVd, TASVd





Insects

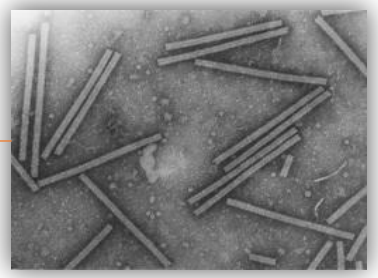
Bean Weevil

Fungi

Botrytis cinerea

Leptospherea maculans

Viruses

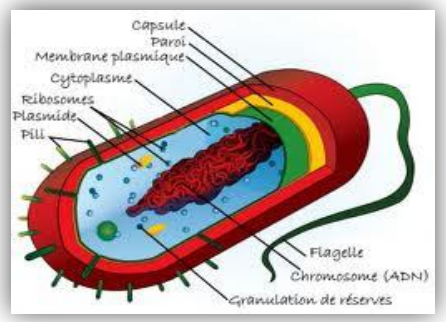


CGMMV, SqMV

Nematodes

Ditylenchus dipsaci

Bacterias



Xcc, Xhc

Location & Transport of seed-borne pests

- **Carried externally**

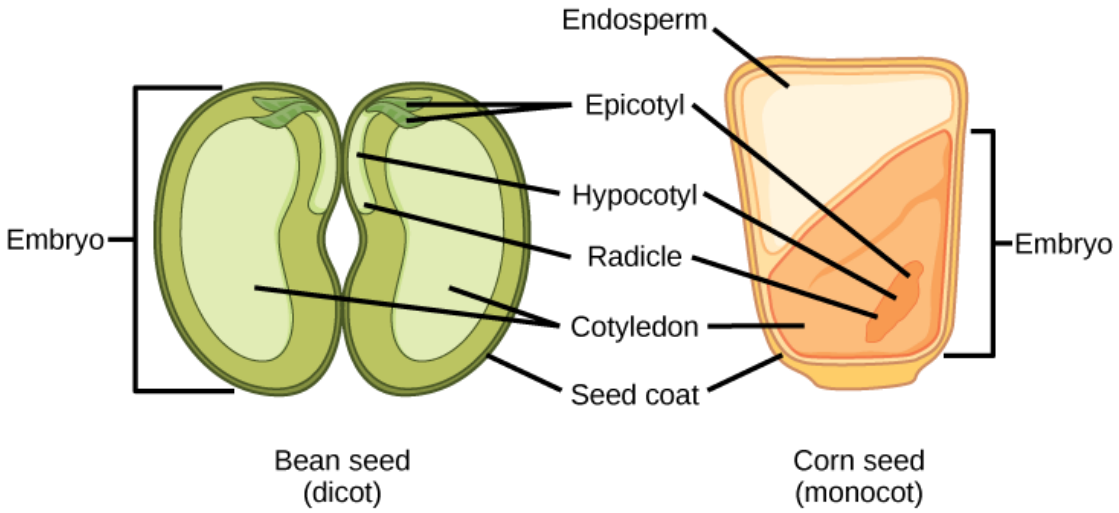
(i.e., seed surface)

- **Carried internally**

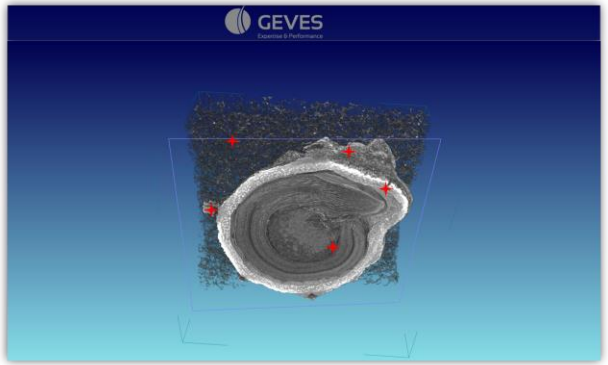
(i.e., seed coat, endosperm, perisperm, embryo)

Depth of colonization – Impact on:

seed treatments & **detection methods**



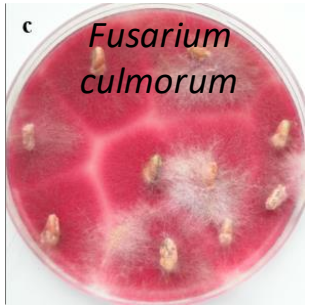
Baker & Smith, Annu. Rev. Phytopathol. (1966); Maude, in: Seedborne diseases and their control: principles and practice (1996)



Seed pathway: entry & establishment in new areas

Seed-borne pests can be **seed-transmitted**

- Pre-/post- emergence damping-off
- Seedlings / plants diseases

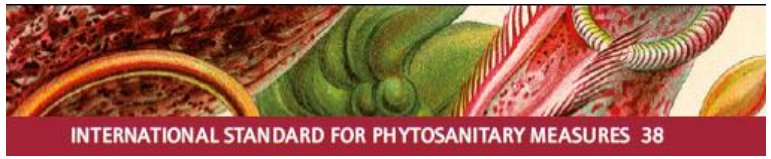


Pests can **escort** seeds **independently**

- i.e., not attached or mixed with debris
- Potential of environment contamination

Seed pathway:

potential of emerging disease



WTO

Why testing for seed health ?

Knowledge of the parties at risk: reasoning behind the seed treatments

- Chemicals(↘)

  Disinfection (hot water, hypochlorite)

- Prevent introduction of a pathogen in a new region: quarantine conditions

- Using healthy seeds is a guarantee for
  - Governments,
  - Seed companies,
  - Producers

- Regulatory framework:
  - IPPS: ISM movement of seeds
  - QP, RNQP regulation (EU) 2016/2031
  - Phytosanitary passports
  - Import documents

- A commercial framework:
  - Guarantee to customers that seeds are health

Food and Agriculture Organization of the United Nations

International Plant Protection Convention

ISPM 38

ENG

International movement of seeds

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Introduction to ISTA

The International Seed Testing Association (ISTA) is an international, non-profit association of seed testing laboratories and individual seed professionals.

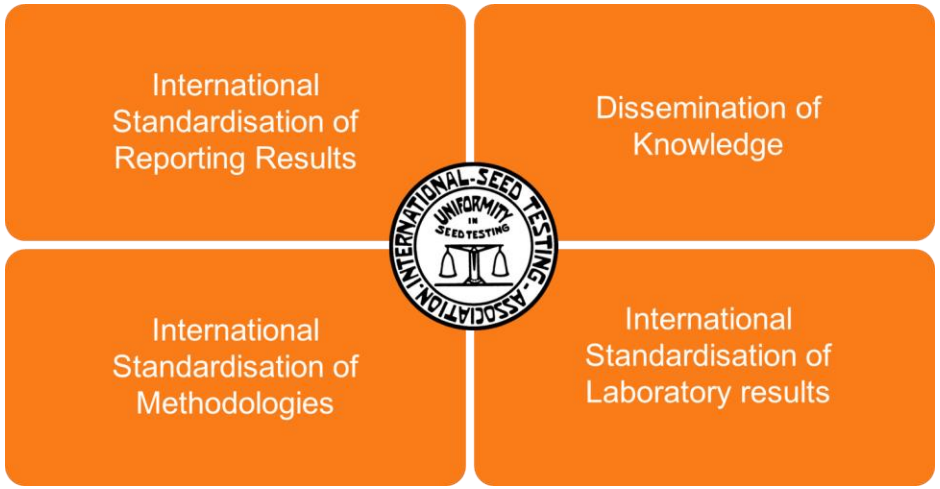
ISTA operates under the governance of the governments of member countries and distinct economies.

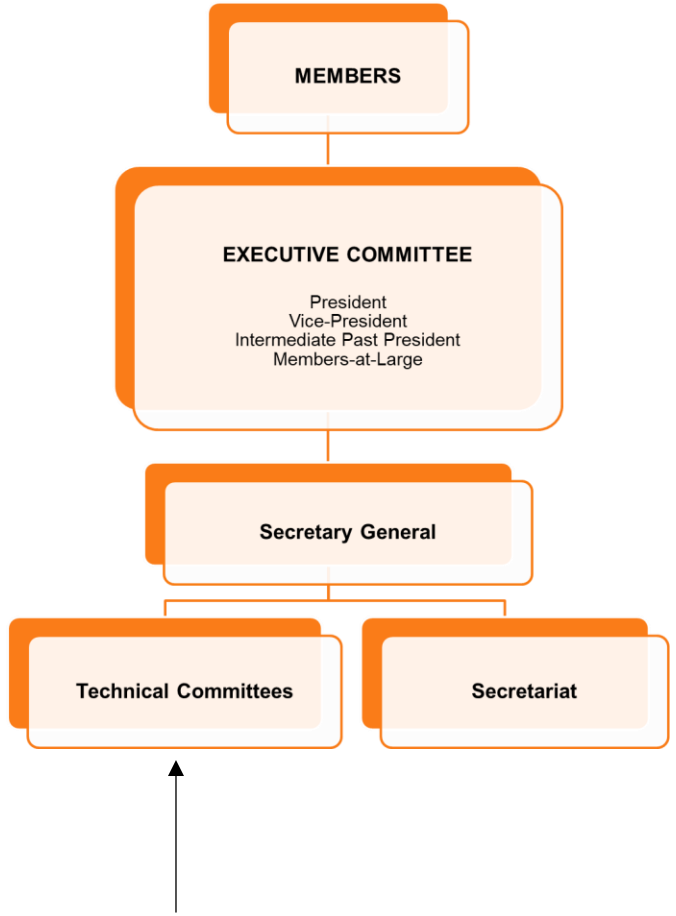
ISTA Objectives

ISTA 100 YEARS
A CENTURY OF PROGRESS IN SEED QUALITY ASSURANCE

Develop, adopt, and publish Standard Procedures for Sampling and testing seeds and promote uniform application of these procedures, for evaluation of seeds moving in international trade.

Promote Research in all areas of seed science and technology.





17 TC's + 2 WG's in total

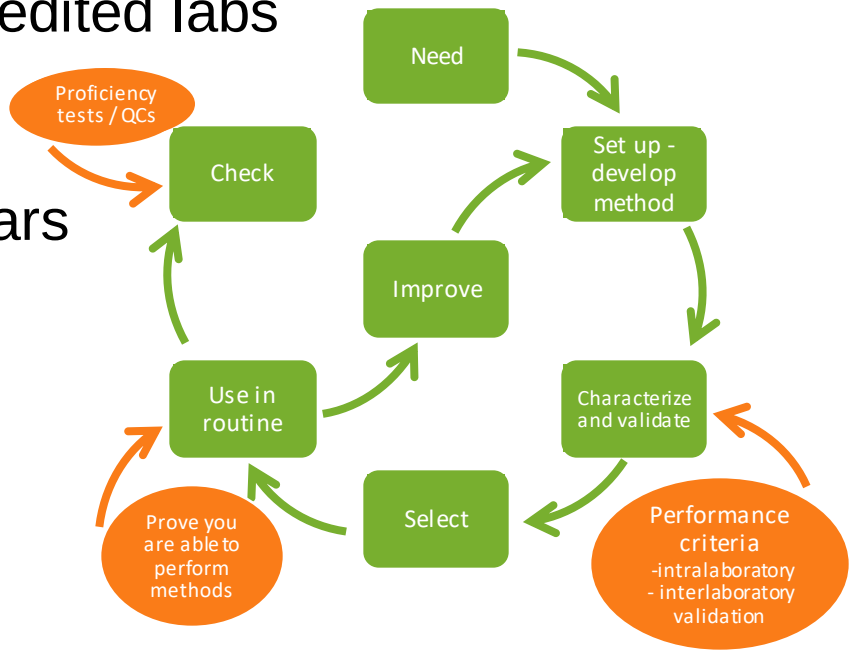
Seed Health Committee

ISTA Seed Health Committee

Consists of 15 Committee Members

Core Business

- Development of new detection methods and updating of current methods
- Review of method validations according to ISTA's validation rules for seed health
- Organisation of proficiency testing to monitor accredited labs
- Execute technical audits for accredited labs
- Active collaboration with other associations
- Educate via workshops and participation in webinars
- Publish of ISTA's Seed Health handbook
- Assist in ISTA special projects
  - *ISTA's reference pest list*
  - *Pathogen image collection database*

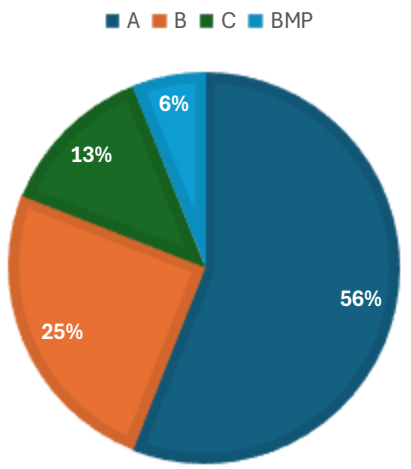


ISTA SHC Rules and Proficiency Testing

- **In 2024 the SHC has 34 Rules**
  - Proficiency of the rules is done via a PT Program

When is a Proficiency test needed?

- To prepare for accreditation
- To get ISTA accredited
- To check how you perform a method
- It is mandatory for ISTA-accredited laboratories to participate in Proficiency Tests.



PT *Ustilago nuda*
Laboratory Ratings

- **A PT is organised by SHC members following the SHC's PT guidelines**

Seed Health Proficiency Test - International Seed Testing Association

Development and validation of a new method

With validation you check for 2 questions:

- ❑ **Is the method I use a good method?**
- ❑ **What is a good method?**

Analytical Sensitivity: The limit of detection (LOD) is usually defined as the lowest quantity or concentration of a pest that can be reliably detected with a given analytical method.

Analytical Specificity: Ability to detect target pests (inclusivity) while not detecting closely related and other organisms or samples which do not contain the target (exclusivity).

Selectivity: Ability to without too much variation, detect the target pest of interest within different seed matrices either belonging to the same crop / plant species or to different plant species.

Robustness: Ability to not vary according to small variations of parameters in the method.

Repeatability: Agreement between independent results with same samples, conditions, method in similar conditions

Reproducibility: Agreement between independent results with same samples and method in different conditions (analyst, equipment, lab)

Diagnostic Sensitivity and Specificity: The ability of a method to produce neither false negatives (diagnostic sensitivity) nor false positives (diagnostic specificity).

ISTA Reference Pest List

An annotated list of seedborne diseases covered about 1300 pests in 385 plant species (Richardson, 1990).

The project covers more than 50 non-vegetable species from 25 botanical families, including cereals, legumes, oilseeds, forest trees, and fruit trees.

THE PLATFORM

A searchable, online image database, with detailed information on pathogen growth influences.

Researchers can submit images to share their knowledge and data with the world. Our team of experts will review them for accuracy before publishing on the website.

WHY CHOOSE US?

This website efficiently bridges the knowledge gap between experts and young scientists. It's accessible to all, accepting image and data submissions from any researcher for free.

www.seedhealthtestimagedb.info

www.seedtest.org

STORY

It began with PDA (Potato Dextrose Agar). A manufacturer altered their formulation to cut costs, resulting in significant changes in culture color and morphology despite ostensibly keeping the ingredients and concentrations the same. This prompted an investigation into whether other labs were aware of the potential impacts of manufacturing changes.

VISION

ISTA promotes information sharing, disseminates knowledge, and trains young seed pathologists. However, the current reference images lack crucial details. Prioritising the education of future plant pathologists is essential amid concerns about food security and seed health.

MISSION

We prioritise seed quality through standardised testing in any accredited lab to ensure consistent results. Comprehensive training encompassing all factors influencing pathogen growth in the lab is essential. Our experts will review the images you submit, fostering shared knowledge and mutual benefits.

Lab based pathogen identification image collection project

Creation of a Seed health pathogen image collection with intended use to:

1. Serve as a training tool for next generation seed pathologists
2. Serve as a reference illustration tool for seed-borne pests detected by seed health tests
3. Visualization of the different characters seed-borne pathogens can have under different growth conditions, media, etc.

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ISTA

ANNUAL MEETING

2024

01-04 JULY

CAMBRIDGE, UNITED KINGDOM

Events - International Seed Testing Association

Proficiency Tests - International Seed Testing Association

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THANK YOU!

www.seedtest.org

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