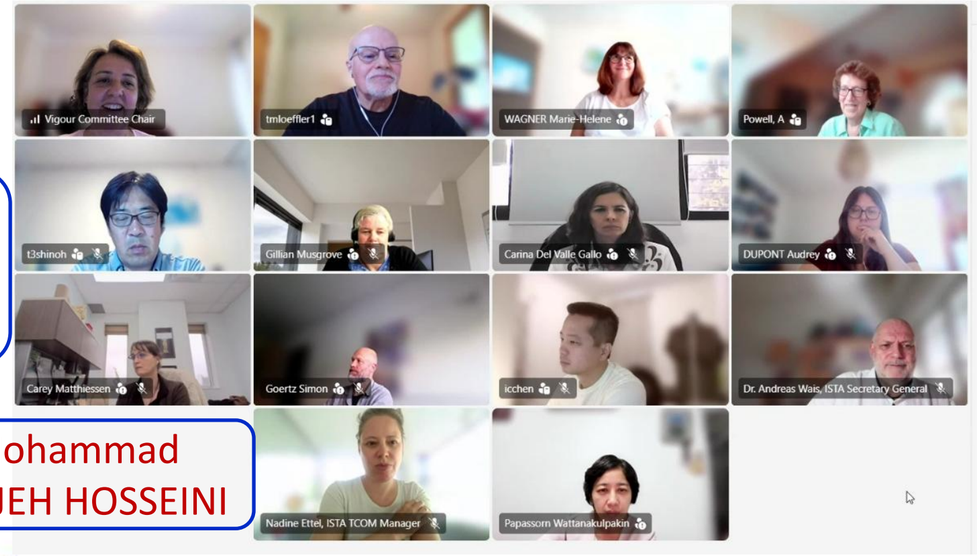
Vigour Committee report

Marie-Hélène Wagner

16 members for VIG-TCOM



Hulya ILBI
VIG TCOM Chair
Ibrahim DEMIR

Alison POWELL
Gillian MUSGROVE

Carey MATTHIESSEN

Simon GOERTZ

Mohammad KHAJEH HOSSEINI

Tim LOEFFLER

Audrey DUPONT
M.-Hélène WAGNER

Online meeting on 1st June

Takashi SHINOHARA

I-Cheng CHEN

Pappasorn WATTANAKULPAKIN

Sunitha B.H.
G.V. JAGADISH

Carina GALLO

https://www.seedtest.org/en/technical-committees/vigour-committee.html

Many thanks to Nadine Ettel

ISTA ANNUAL MEETING 2026

An ambitious program 2026-2028

- 20 Working Groups including 2 which leaders are not members of VIG-TCOM
- Around 7 new species for RE test: the most practical vigour test in a seed laboratory dealing with germination tests
- 2 special projects led by Alison Powell, former chair, to explain PT results
  - PT24-1: Radicle emergence test for wheat
  - PT23-2: Electro-conductivity for radish

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Working groups related to VIG-TCOM

- Wilasinee Ramnut (Chia Taï): RE test for watermelon
  - Method development using 10 seed lots and testing two temperatures

- Mauro Vacarella (CREA): RE test for durum wheat
  - In-house method to be published
  - Comparative tests with TCOM members in 2027

ISTA ANNUAL MEETING 2026

RE test for wheat: Alison Powell

- Mini-comparative test (48h at 15°C) with 6 seed lots in 2025 provided by NPZ
- 4 participants including 2 laboratories involved in the ISTA PT24-1
- Repeatability good within a lab, as seen in the ISTA PT24-1
- Reproducibility poor both for RE *sensu stricto* and RE 2 mm
- Investigation regarding water availability in paper

PT24-1: Coefficient of variation obtained by accredited laboratories

	Lot 1	Lot 2	Lot 3
CV	58.38%	50.85%	18.35%

	Lot 1	Lot 2	Lot 3
CV 2 labs	33.7%	20.5%	7.9%

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RE test for barley: Simon Goertz

- Comparative tests (48h at 15°C) in 2025 with 12 seed lots
- 6 participants from Canada, Iran, Scotland, Ireland, Germany and France,
- Results on-going
- Comparison of paper in one laboratory to improve contrast between radicle and background (BP white and PP blue)

Radicle emergence *sensu stricto* for barley (%)		
Seed lot	RE 48h BP	RE 48h PP
4	83	64
5	82.5	61
6	87	70.5
7	100	98
8	99.5	98
9	99	96.5

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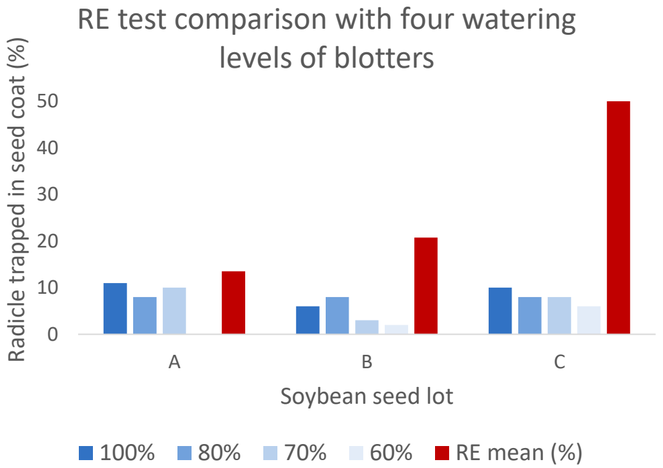
RE test for soybean: Carina Gallo

- Method in ISTA Rules: 48h at 20°C - BP- radicle at least 2mm length
- Request done the 1st of June to anticipate PT 27-3: could paper water holding capacity affect the number of radicles trapped in seed coat?
- 3 seed lots presenting radicles trapped in seed coat (RT) tested on 4 x 50
- 4 levels of paper moistening: no significant variation of trapped radicles

Figure 1. Seedlings with radicles trapped by the seed coat.



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CD test for tomato: Audrey Dupont

- Minor revisions to the test plan
  - Focus on controlled deterioration test: 48h at 47°C - 30% of SMC
  - Participants asked to carry out also germination test to evaluate experience on this species
- Six participating laboratories worldwide: Thailand with two participants, Netherlands, Japan, Turkey, France
- Two laboratories will evaluate usable transplants in greenhouse to assess vigour
- Six seed lots from two cultivars, shipment ready to leave France

Many thanks to reviewers
Ibrahim Demir
Gillian Musgrove
Nick Syring

Successful workshop with GER-TCOM

- 1st-5th December 2025 in Angers
- 27 participants from 12 countries
- 11h of lectures and 14h of practice
- 7h of social activities

Gillian Musgrove - Alison Powell
Sylvie Ducournau - Didier Demilly
Marie-Hélène Wagner

Special thank to
Laura Cordier
A-Nicoleta Pinar

One or two workshops to organise in 2027

- India in Bangalore with the topic: " Vigour test and its application in inventory seed management"

Seasoned@ISTA

https://seedworld.com/cdn/flipbooks/ISTA/169-apr-2025/index.html?page=42

- APSA?

ISTA ANNUAL MEETING 2026

Publications

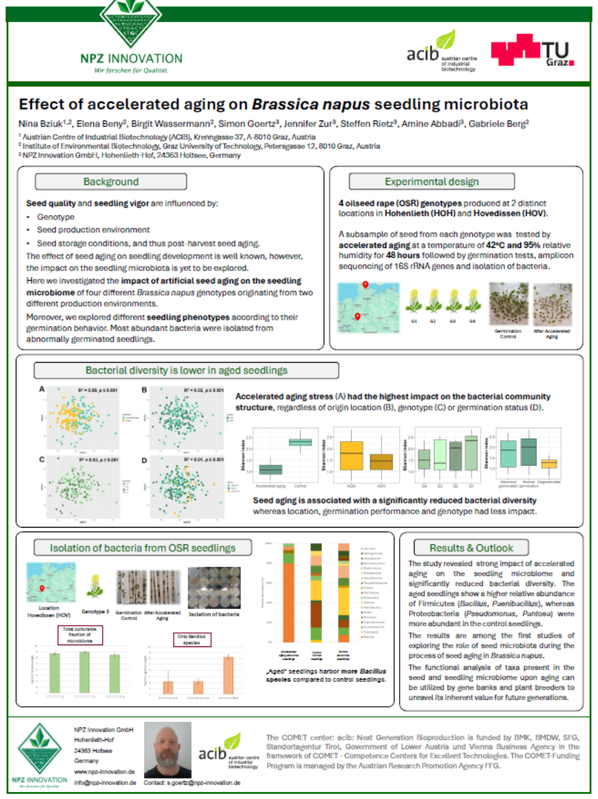
Seed Science Research

cambridge.org/ssr

Research Paper

Accelerated aging caused diversity and specificity loss in the bacterial communities of *Brassica napus* seedlings

Nina Bziuk[1,2,*], Simon Görtz[3], Jennifer Zur[3], Elena Beny[2], Steffen Rietz[3], Amine Abbadi[3], Birgit Wassermann[1,2,#] and Gabriele Berg[2,4,5,#]



NPZ INNOVATION

acib austrian centre of industrial biotechnology

TU Graz

Effect of accelerated aging on *Brassica napus* seedling microbiota

Nina Bziuk[1,2], Elena Beny[2], Birgit Wassermann[2], Simon Goertz[3], Jennifer Zur[3], Steffen Rietz[3], Amine Abbadi[3], Gabriele Berg[2]

[1] Austrian Centre of Industrial Biotechnology (ACIB), Krenngasse 37, A-8010 Graz, Austria
[2] Institute of Environmental Biotechnology, Graz University of Technology, Petersgasse 12, 8010 Graz, Austria
[3] NPZ Innovation GmbH, Hohenlieth-Hof, 24363 Holtsee, Germany

Background

Seed quality and **seedling vigor** are influenced by:

- Genotype
- Seed production environment
- Seed storage conditions, and thus post-harvest seed aging.

The effect of seed aging on seedling development is well known, however, the impact on the seedling microbiota is yet to be explored.

Here we investigated the **impact of artificial seed aging on the seedling microbiome** of four different *Brassica napus* genotypes originating from two different production environments.

Moreover, we explored different **seedling phenotypes** according to their germination behavior. Most abundant bacteria were isolated from abnormally germinated seedlings.

Experimental design

4 oilseed rape (OSR) genotypes produced at 2 distinct locations in **Hohenlieth (HOH)** and **Hovedissen (HOV)**.

A subsample of seed from each genotype was tested by **accelerated aging** at a temperature of **42°C and 95%** relative humidity for **48 hours** followed by germination tests, amplicon sequencing of 16S rRNA genes and isolation of bacteria.

Bacterial diversity is lower in aged seedlings

Accelerated aging stress (A) **had the highest impact on the bacterial community structure**, regardless of origin location (B), genotype (C) or germination status (D).

Seed aging is associated with a significantly reduced bacterial diversity whereas location, germination performance and genotype had less impact.

Isolation of bacteria from OSR seedlings

„Aged" seedlings harbor more *Bacillus* species compared to control seedlings.

Results & Outlook

The study revealed strong impact of accelerated aging on the seedling microbiome and significantly reduced bacterial diversity. The aged seedlings show a higher relative abundance of Firmicutes (*Bacillus*, *Paenibacillus*), whereas Proteobacteria (*Pseudomonas*, *Pantoea*) were more abundant in the control seedlings.

The results are among the first studies of exploring the role of seed microbiota during the process of seed aging in *Brassica napus*.

The functional analysis of taxa present in the seed and seedling microbiome upon aging can be utilized by gene banks and plant breeders to unravel its inherent value for future generations.

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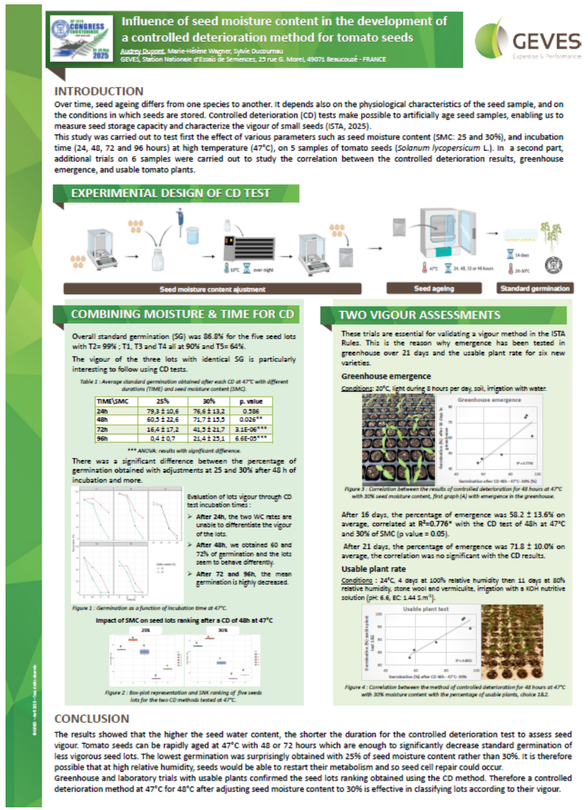
The COMET center: acib: Next Generation Bioproduction is funded by BMK, BMDW, SFG, Standortagentur Tirol, Government of Lower Austria und Vienna Business Agency in the framework of COMET - Competence Centers for Excellent Technologies. The COMET Funding Program is managed by the Austrian Research Promotion Agency FFG.



Influence of seed moisture content in the development of a controlled deterioration method for tomato seeds

Audrey Dupont, Marie-Héléne Wagner, Sylvie Ducournau
GEVES, Station Nationale d'Essais de Semences, 25 rue E. Morel, 49071 Beaucouzé - FRANCE

GEVES

INTRODUCTION

Over time, seed ageing differs from one species to another. It depends also on the physiological characteristics of the seed sample, and on the conditions in which seeds are stored. Controlled deterioration (CD) tests make possible to artificially age seed samples, enabling us to measure seed storage capacity and characterize the vigour of small seeds (ISTA, 2025).

This study was carried out to test first the effect of various parameters such as seed moisture content (SMC: 25 and 30%), and incubation time (24, 48, 72 and 96 hours) at high temperature (47°C), on 5 samples of tomato seeds (*Solanum lycopersicum* L.). In a second part, additional trials on 6 samples were carried out to study the correlation between the controlled deterioration results, greenhouse emergence, and usable tomato plants.

EXPERIMENTAL DESIGN OF CD TEST

Seed moisture content ajustment | Seed ageing | Standard germination

COMBINING MOISTURE & TIME FOR CD

Overall standard germination (SG) was 86.8% for the five seed lots with T2= 99% ; T1, T3 and T4 all at 90% and T5= 64%.

The vigour of the three lots with identical SG is particularly interesting to follow using CD tests.

Table 1 : Average standard germination obtained after each CD at 47°C with different durations (TIME) and seed moisture content (SMC).

TIME\SMC	25%	30%	p. value
24h	79,3 ± 10,6	76,6 ± 13,2	0.586
48h	60,5 ± 22,6	71,7 ± 15,5	0.026**
72h	16,4 ± 17,2	41,7 ± 21,7	3.1E-06***
96h	0,4 ± 0,7	21,4 ± 25,1	6.6E-05***

*** ANOVA: results with significant difference.

There was a significant difference between the percentage of germination obtained with adjustments at 25 and 30% after 48 h of incubation and more.

Evaluation of lots vigour through CD test incubation times :

- After 24h, the two WC rates are unable to differentiate the vigour of the lots.
- After 48h, we obtained 60 and 72% of germination and the lots seem to behave differently.
- After 72 and 96h, the mean germination is highly decreased.

Figure 1 : Germination as a function of incubation time at 47°C.

Impact of SMC on seed lots ranking after a CD of 48h at 47°C

Figure 2 : Box-plot representation and SNK ranking of five seeds lots for the two CD methods tested at 47°C.

TWO VIGOUR ASSESSMENTS

These trials are essential for validating a vigour method in the ISTA Rules. This is the reason why emergence has been tested in greenhouse over 21 days and the usable plant rate for six new varieties.

Greenhouse emergence

Conditions: 20°C, light during 8 hours per day, soil, irrigation with water.

Figure 3 : Correlation between the results of controlled deterioration for 48 hours at 47°C with 30% seed moisture content, first graph (A) with emergence in the greenhouse.

After 16 days, the percentage of emergence was 58.2 ± 13.6% on average, correlated at R²=0.776* with the CD test of 48h at 47°C and 30% of SMC (p value = 0.05).

After 21 days, the percentage of emergence was 71.8 ± 10.0% on average, the correlation was no significant with the CD results.

Usable plant rate

Conditions : 24°C, 4 days at 100% relative humidity then 11 days at 80% relative humidity, stone wool and vermiculite, irrigation with a KOH nutritive solution (pH: 6.6, EC: 1.44 S.m⁻¹).

Figure 4 : Correlation between the method of controlled deterioration for 48 hours at 47°C with 30% moisture content with the percentage of usable plants, choice 1&2.

CONCLUSION

The results showed that the higher the seed water content, the shorter the duration for the controlled deterioration test to assess seed vigour. Tomato seeds can be rapidly aged at 47°C with 48 or 72 hours which are enough to significantly decrease standard germination of less vigorous seed lots. The lowest germination was surprisingly obtained with 25% of seed moisture content rather than 30%. It is therefore possible that at high relative humidity, seeds would be able to restart their metabolism and so seed cell repair could occur.

Greenhouse and laboratory trials with usable plants confirmed the seed lots ranking obtained using the CD method. Therefore a controlled deterioration method at 47°C for 48°C after adjusting seed moisture content to 30% is effective in classifying lots according to their vigour.

Evaluation of camelina (*Camelina sativa*) seed quality during storage in relation to seed moisture and temperature

Authors: Khajeh-Hosseini, Mohammad; Cheshmeh-Sefidi, Rana; Yaghoubi, Fatemeh
Source: Seed Science and Technology, Volume 53, Number 1, April 2025, pp. 91-104(14)
Publisher: International Seed Testing Association
DOI: https://doi.org/10.15258/sst.2025.53.1.08

Seed vigour tests to predict seed quality after storage in spinach seed lots

Authors: Guloksuz, Tuba [1]; Eker, Hakan A. [2]; Demir, Ibrahim [1];
Source: Seed Science and Technology, Volume 54, Number 1, April 2026, pp. 1-11(11)
Publisher: International Seed Testing Association
DOI: https://doi.org/10.15258/sst.2026.54.1.01

BAHÇE 54 (Özel Sayı 1): 26–30 (2025)
https://doi.org/10.53471/bahce.1540106

Electrical Conductivity Relates Seed Germination and Seedling Emergence in Tagetes Seed Lots

Tuba GÜLÖKSÜZ[1], Ahmet Hakan EKER[2], Nihal ERTÜRK[3], Neslihan KADIOĞLU[4], İbrahim DEMİR[5]*

A controlled deterioration method for assessing the vigour of tomato seed lots

Authors: Dupont, Audrey; Wagner, Marie-Héléne; Ducournau, Sylvie
Source: Seed Science and Technology, Volume 54, Number 1, April 2026, pp. 13-18(6)
Publisher: International Seed Testing Association
DOI: https://doi.org/10.15258/sst.2026.54.1.02

ISTA ANNUAL MEETING 2026

A much-anticipated handbook, coming soon

- A huge work lead and edited by **Alison Powell**
- Fourth edition of the vigour testing handbook
- Contents
  - Chapter 1: General introduction
  - Chapter 2: Important aspects of vigour testing
  - Chapter 3: AA test
  - Chapter 4: EC test
  - Chapter 5: CD test
  - Chapter 6: RE test
  - Chapter 7: TZ test
  - Chapter 8: SSAA test
  - Chapter 9: CT test
  - Chapter 10: Validated tests applied to other species

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Preview extracts from the handbook

Many thanks to Vanessa Sutcliffe

Chapter 3: Accelerated ageing test

3.1 Background

The Accelerated Ageing (AA) test was first developed within the seed technology programme at Mississippi State University as a means of predicting seed storage potential in the warm, humid conditions found in that state and in the many countries from which the students in the research programme originated (Delouche and Baskin, 1973). The test is based on the seed survival curve, or pattern of loss of the ability to germinate, as described in the General Introduction, whereby seeds initially show a slow decline in germination, followed by a rapid loss of the ability to germinate. The rate at which this decline in germination occurs is determined by the storage conditions, with an increase in seed moisture content (MC) and/or the temperature of storage increasing the rate of ageing and the loss of the ability to germinate. The seed MC itself is a function of the initial seed MC and the relative humidity (RH) of the storage atmosphere. Seeds are hydrophilic, with a very low seed water potential. Therefore, if they are placed in conditions of high humidity, they will absorb water from the atmosphere, the seed MC increases, and they age rapidly. The rate at which ageing occurs depends on the actual RH / seed MC and temperature, but can be within hours, days, or months.

The AA test has been examined for many species (AOSA, 2012). The most rigorous examination of the test and the variables that affect the test results has been completed for soybean (*Glycine max* L. Merr.) (AOSA, 2012;. The effects of seed moisture content, fungicide treatment, seed size, temperature and RH have all been examined, leading to the standardisation of the test procedure. This work has also shown that the test results not only predict seed vigour of soybean as reflected in seed storage potential, but also the field emergence of seed lots (Byrd and Delouche, 1971; Egli and TeKrony, 1995, 1996). The test was ISTA validated for soybean in 2001 and included in the ISTA Rules from 2002.

3.2 Principle

The AA test exposes seeds for a short period to high temperature (41 °C) and high relative humidity (≈ 95 %). During the test, the seeds absorb moisture from the humid environment resulting in an increased seed MC, which, along with the high temperature, causes rapid seed ageing. High vigour seed lots will retain a high germination after the period of ageing, whereas that of low vigour lots is reduced.

3.3 Current app
accelerated age

The AA vigour test is curr
dict both field emergence
be aged should not be trea
ever, if seeds are marketed
seeds may be tested. It is
for seed lots that are treat

3.4 Accelerated

3.4.1 Equipment

Balance: An analytical
nearest 0.001 g.

Plastic AA box: Sometim
This is a plastic box (
depth) with a lid, into
with a 10.0×10.0×3.0
screen (Fig. 3.1a). The
be 1.16 ±0.01 mm × 1.
trays can be purchase
cording to the guidelin
designs for the AA box
circular box with a d
Argentina (Fig. 3.1b).
densation forms, it run
of the box into the w
not fall on the seeds.
that described by Ellic
(Fig. 3.1b).

Bottle-top dispenser: V
used to dispense 40 m
bottle into the plastic A
uated cylinder can be

Ageing chamber: An ag
ing a constant temper
water-jacketed ageing
but any accurate incub
perature to within ±0.
case the relative humi
be maintained by pla
filled with water in t
temperature rooms ca
maintain 41 ±0.5 °C.
essential as any fluctu
formation of condens
curs water can drop
possibly leading to fu

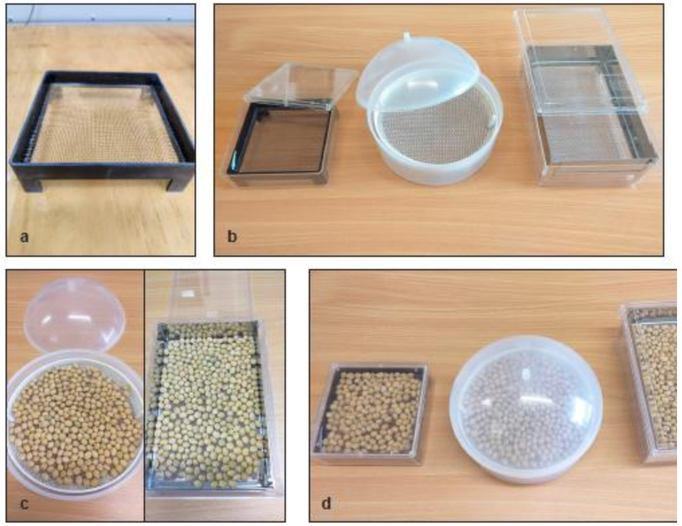


Figure 3.1 **a** Mesh screen on which seed will be placed; **b** Examples of accelerated ageing boxes; **c** Accelerated a
plus single layer of seed on mesh screen; **d** Closed accelerated ageing boxes.

Figure 3.2 Examples of water-jacketed incubators. Other makes are available that meet the required standards for the accelerated ageing test. Note that a controlled temperature room can also be used if it can reliably maintain 41 ±0.5 °C.

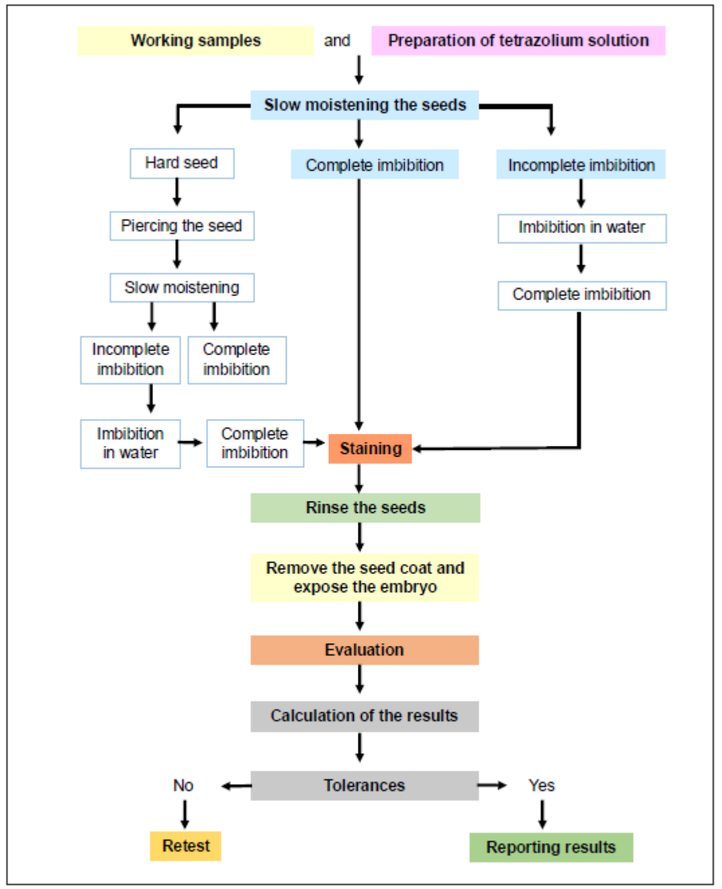
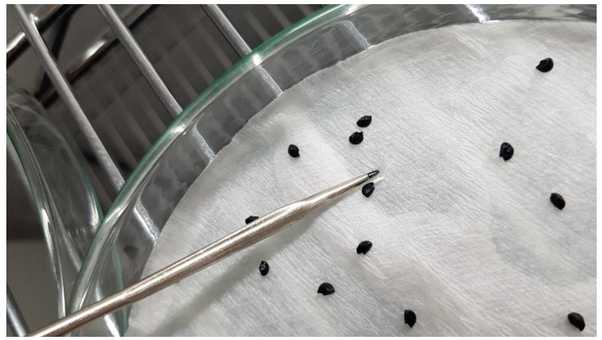


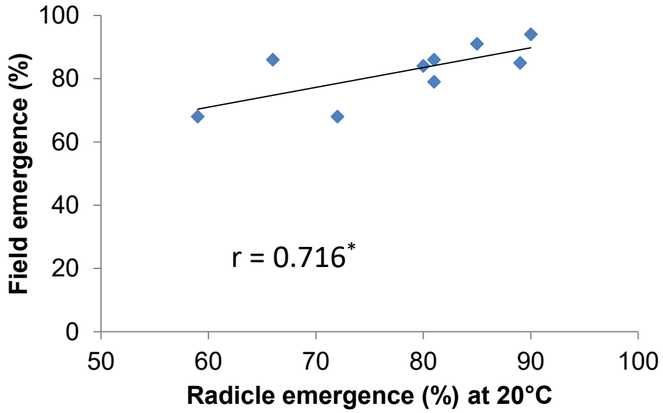
Figure 7.1 Flow diagram of the tetrazolium test for seed vigour.

ISTA ANNUAL MEETING 2026

Rules proposals: new species for RE test

- Onion: no remark during the online meeting on 13th May
- Method: 72h at 20°C – TP – radicle at least 2mm length





PROPOSED VERSION					
Table 15B Specific conditions for the radicle emergence test procedures…					
Species	**Germination medium**	**Replication**	**Germination temperature**	**Criterion of radicle emergence**	**Timing of radicle emergence count**
Allium cepa	Top of paper	4 x 50 seeds	20 ± 1°C	Production of 2mm radicle	72h ±15 min

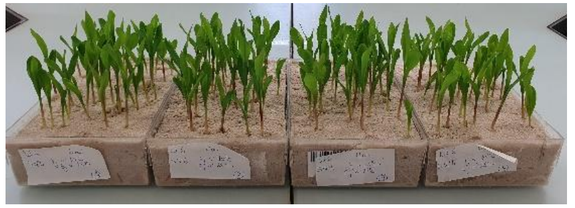
ISTA ANNUAL MEETING 2026

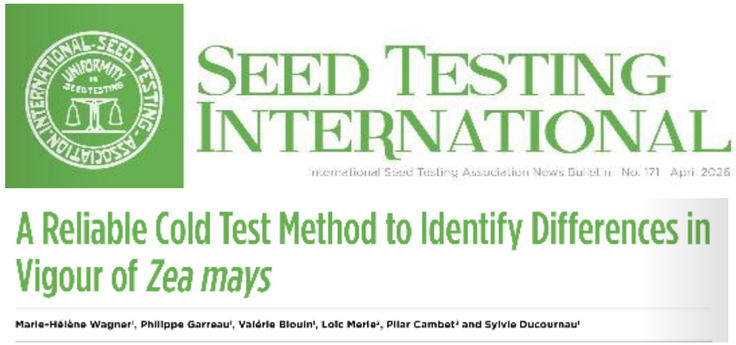
Rules proposals: new test in chapter 15 towards uniformity in cold test for maize

- 7d at 10°C and 5d at 25°C with a higher watering than for germination test
- sand and rolled paper (BP) usable as for germination test

Substrate	# Users		# Users TOTAL
	Accredited labs	Voluntary participants	
BP	66	35	**101**
TP	3	2	**5**
PP	2	3	**5**
Sand	55	25	**80**
Soil	1		**1**
Not reported	1	1	**2**

PT21-1 *Z.mays* - GER



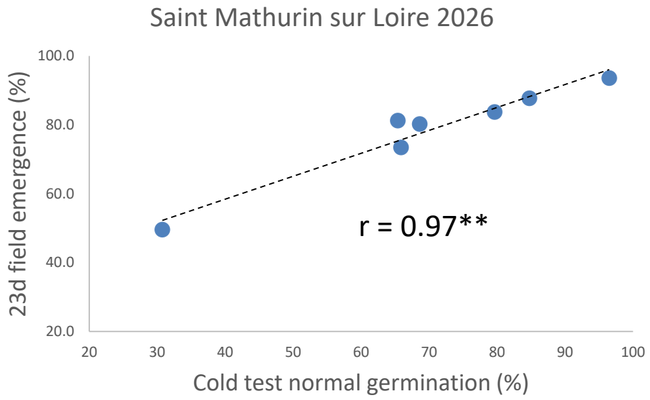


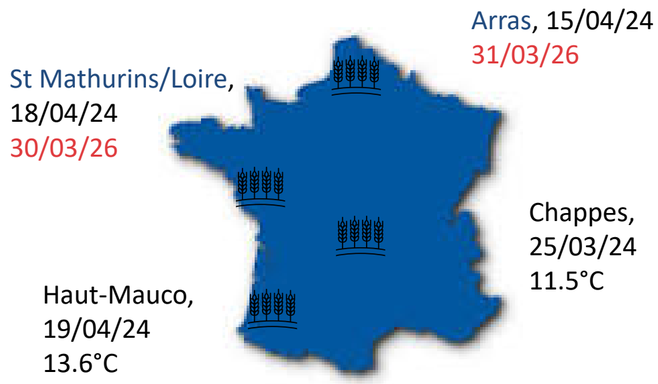
- New trials in 2026 for 7 grain maize and 4 sweet corn
- A total of 33 seed lots were tested in one lab to compare both substrates

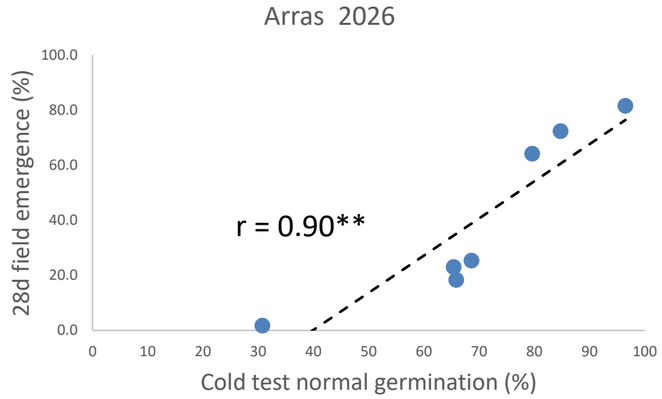
ISTA ANNUAL MEETING 2026

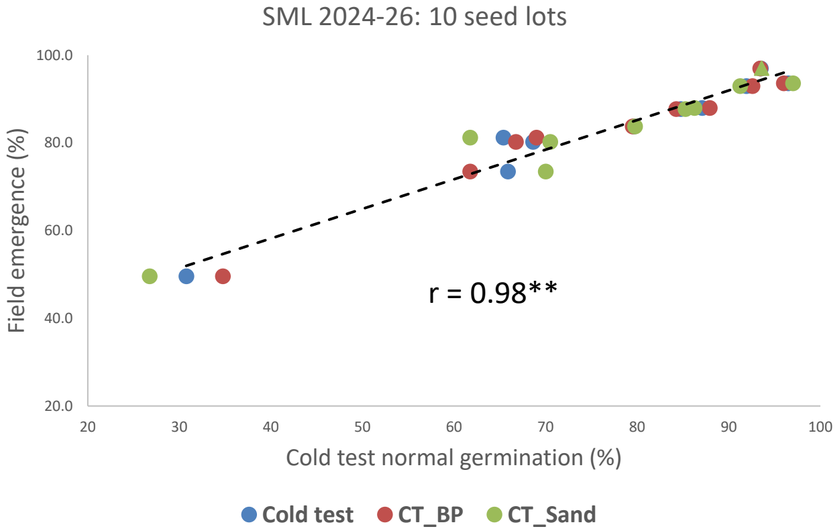
Cold test for maize: 2 years of field trials

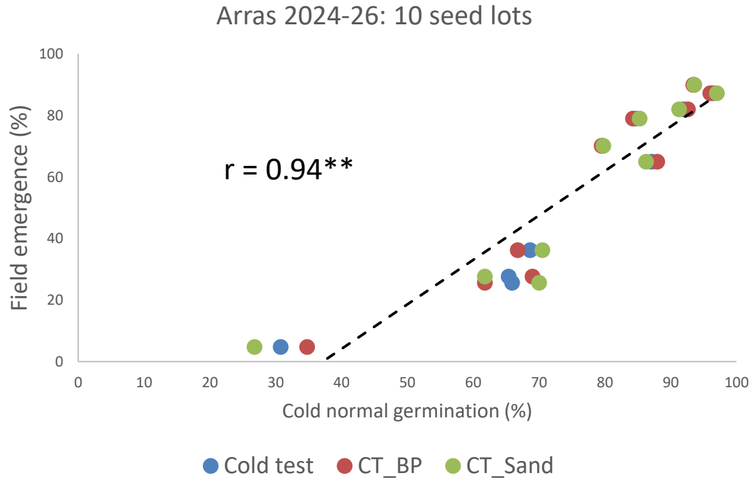
- Reflecting field emergence under stressful conditions
- Both substrates identify seed vigour ranking in two field trials











ISTA ANNUAL MEETING 2026

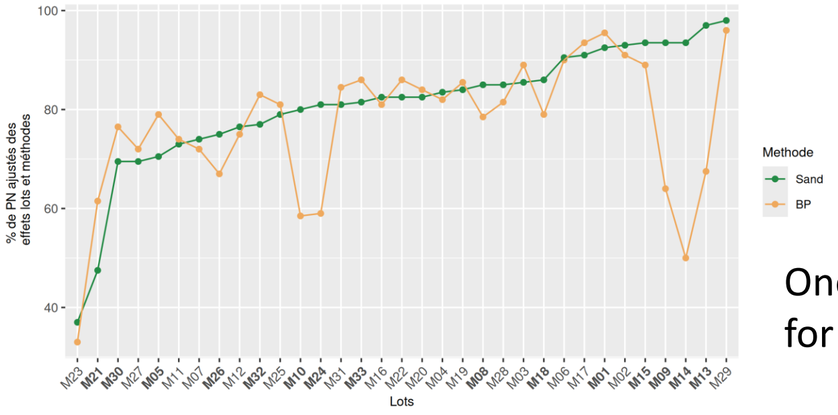
Cold test: interaction seed lot and substrate

- A second substrate not usual in a laboratory: training is necessary to adapt seedling evaluation in a new substrate
- Significant interaction obtained with less vigourous samples once trained

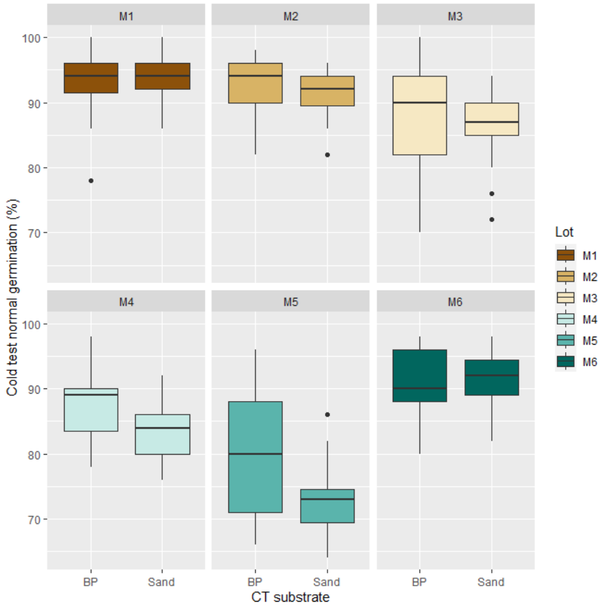
Overall mean of cold test normal germination (%) for 33 *Zea mays* seed lots tested from 2022 to 2026

Sand: 81 ± 13.5	BP: 77 ± 14.7

Effect	ddl	p-value	signif
Lot	**32**	**0.0000**	**≤5%**
Substrate	1	0.0726	5 to 10%
Lot:Substrate	**32**	**0.0000**	**≤5%**



One laboratory using sand for its in-house cold test



6 laboratories in comparative cold tests in 2024

ISTA ANNUAL MEETING 2026

Rules proposals: improvement of RE test for soybean

- Introduced in 2025 in ISTA Rules, some questions to VIG-TCOM
- Proposal to help seed technologists in RE evaluation

Seeds in which the radicle has emerged, but the tip remains trapped within the seed coat are not included.

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Thank you, any question?