"Further strengthening of capacities of phytosanitary sector in the fields of plant protection products, plant health and seeds and seedlings, including phytosanitary laboratories and phytosanitary inspections"
(TWINNING BA/12/IB/AG 01)

Component 3: Seeds and propagation materials

ISTA RULES FOR GERMINATION TEST

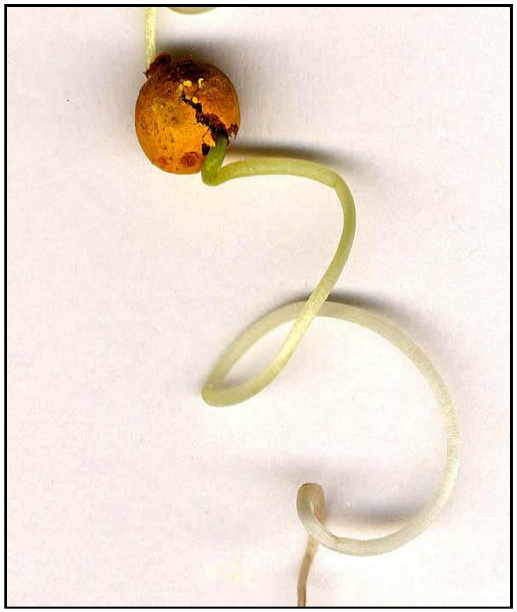
Rita Zecchinelli

Object:

determine the germination potential of a seed lot

Normal seedlings

intact- with slight defects - with secondary infection



Abnormal seedlings

damaged – deformed/unbalanced- decayed

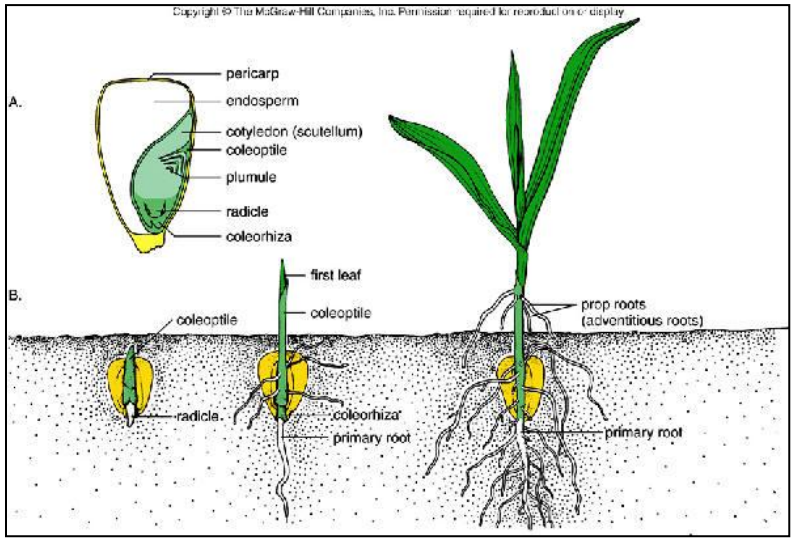
Other categories of seeds

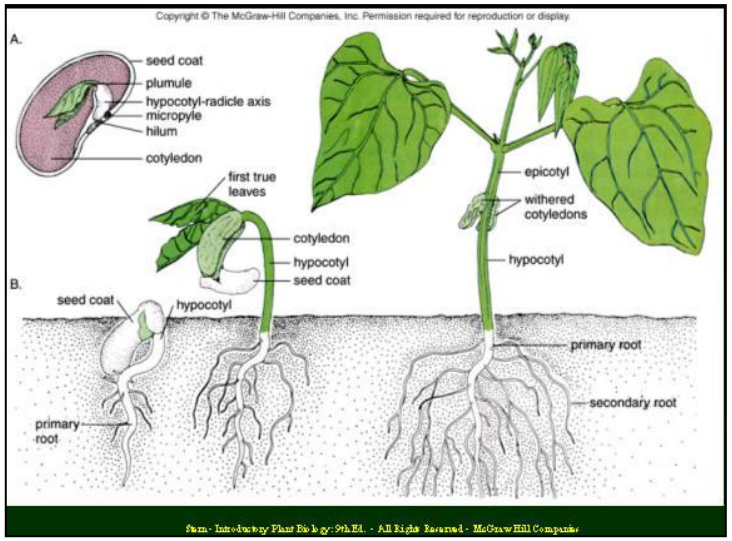
- **fresh seeds** (able to imbibe water, but germination is blocked)
- **hard seeds** (not able to imbibe water, remain hard)
- **dead seeds** (usually soft, discoloured, mouldy)

Seedling evaluation
• systematic class

monocots

dicots

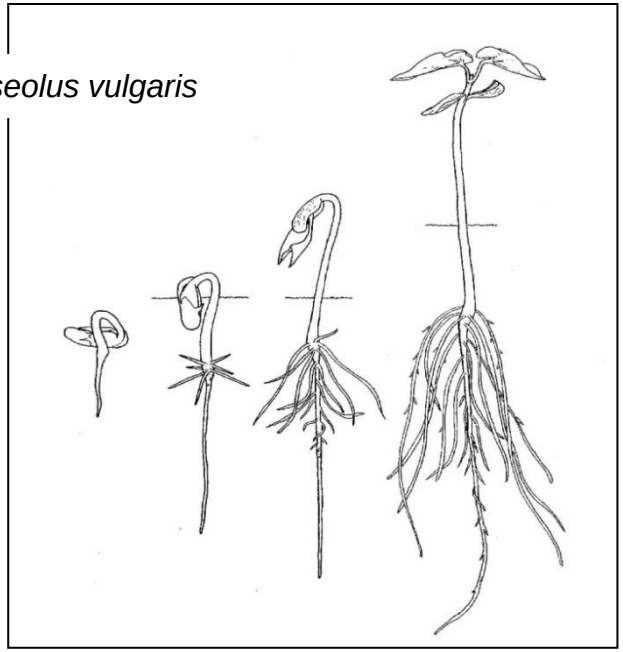




Seedling evaluation – germination mode

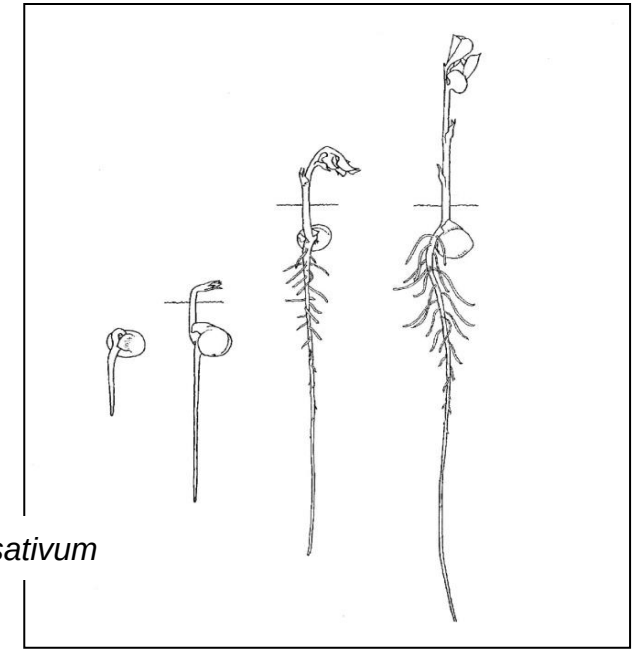
Epigeal:
cotyledons above the ground

Phaseolus vulgaris

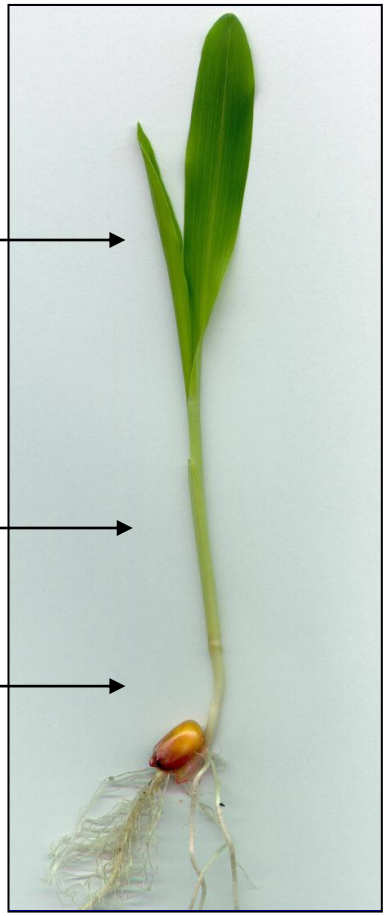


Hypogeal:
cotyledons remain in the soil

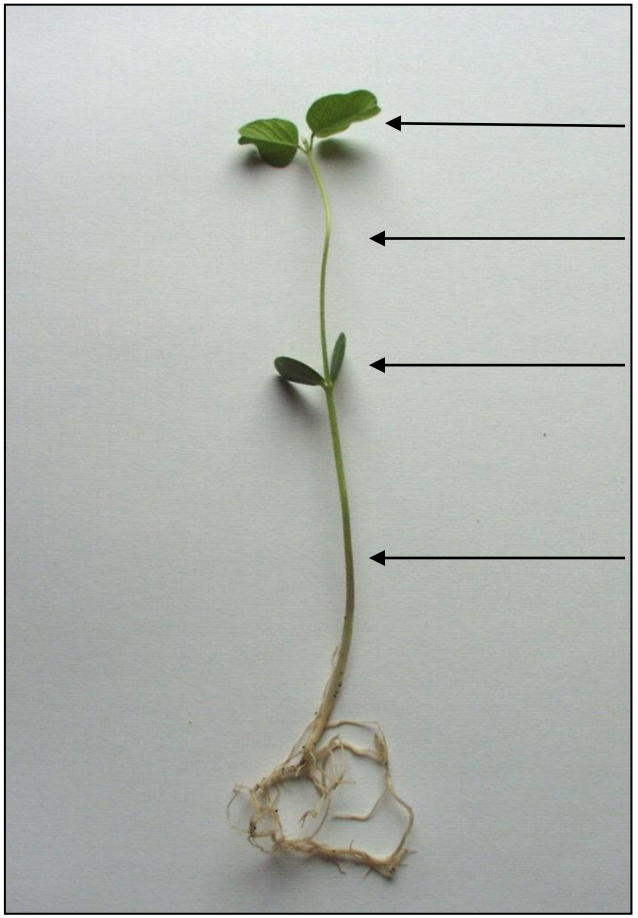
Pisum sativum



Seedling evaluation – shoot system



Zea mays



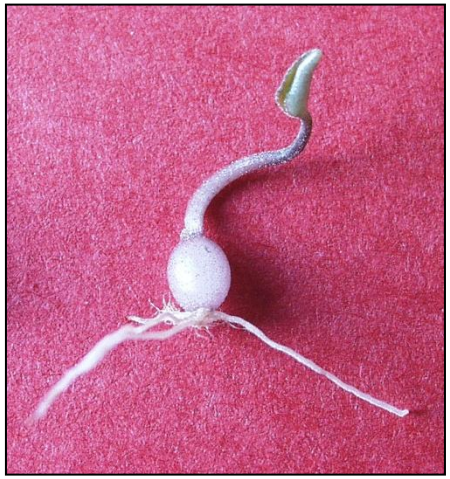
Glycine max

Seedling evaluation – shoot system

non elongated epicotyl

elongated epicotyl

coleoptile enclosing the shoot tip



hypocotyl forming a tuber

Seedling evaluation – root system

Primary root essential

Examples
Helianthus annuus, Medicago* spp., *Beta vulgaris

Secondary roots may compensate for for the primary root

Examples
Glycine max, Pisum sativum, Zea mays

Several equal seminal roots

Examples
***Avena sativa, Hordeum vulgare, Triticum* spp.**

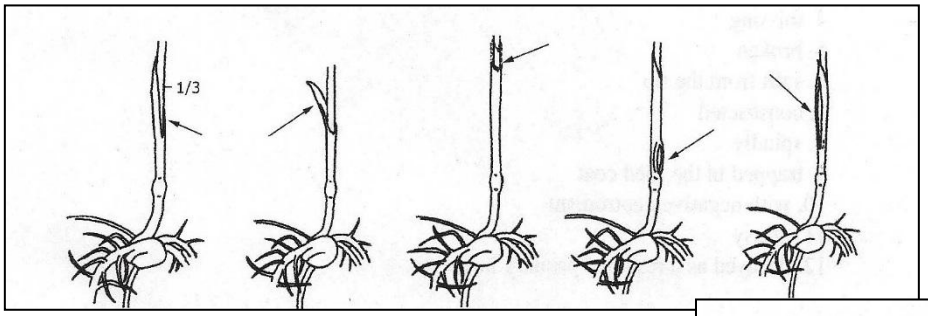
Evaluation of the coleoptile (wheat)

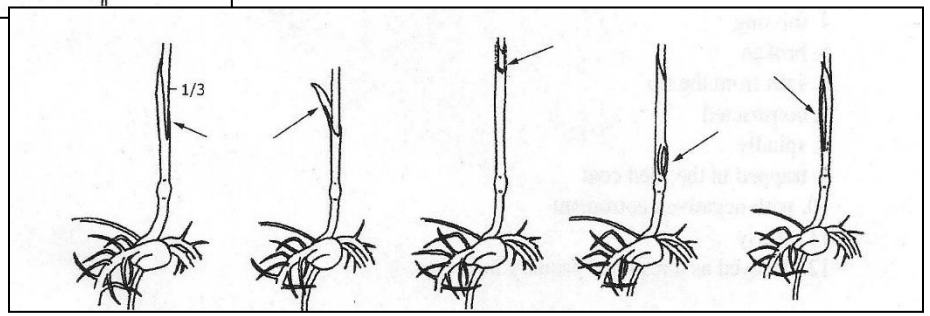
split > 1/3

Split from the basis

The seedling is abnormal

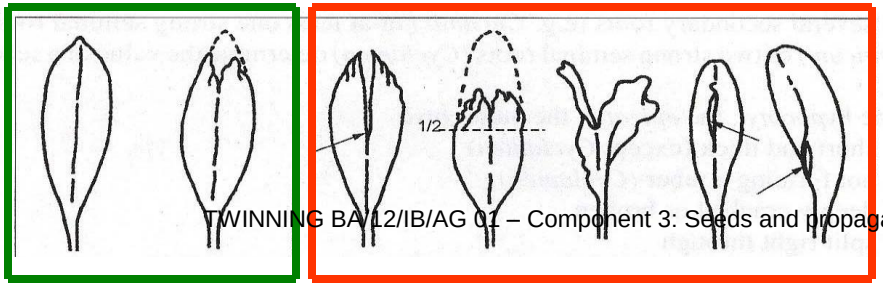
Evaluation of the coleoptile (maize)



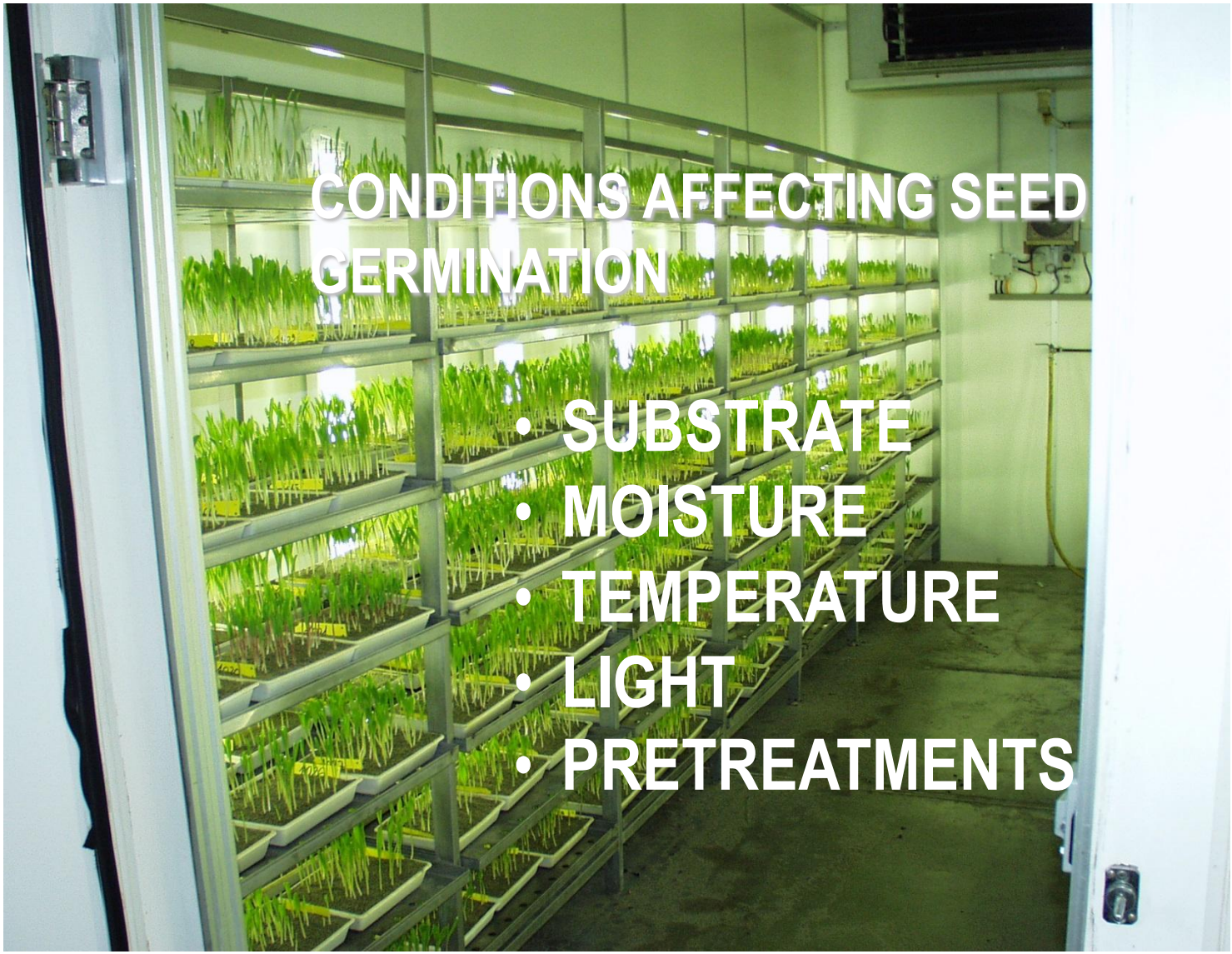


Normal seedlings

Abnormal seedlings



WORKING SAMPLE
400 seeds
(from the pure seed fraction)


CONDITIONS AFFECTING SEED GERMINATION
• SUBSTRATE
• MOISTURE
• TEMPERATURE
• LIGHT
• PRETREATMENTS

SUBSTRATES

Growing media (ISTA Rules):

Paper Sand

Organic growing media

Soil

MOISTURE

THE SUBSTRATE MUST AT ALL TIMES CONTAIN SUFFICIENT MOISTURE TO MEET THE REQUIREMENTS OF GERMINATION (DEPENDING ON THE SPECIES).

SOME SPECIES ARE MORE SENSITIVE THAN OTHERS TO EXCESSIVE MOISTURE (e.g. *Trifolium* spp., *Nicotiana Tabacum* and other small seeded species).

Water: demineralized, deionized, tap, spring water

TEMPERATURE

- constant
- alternate

LIGHT

- absent
- present

750-1250 lux

PRETREATMENTS

- Pre-chilling (5 – 10 °C – up to 7 days)
- Potassium nitrate (KNO_3)
- Gibberellic acid (GA_3)
- Prewashing
- Preheating
- Others

EQUIPMENT

DURATION OF THE TEST

- 1st Count
- Final Count

- Indicated in Table 5A.
- It can be extended or the test can be terminated before the prescribed time (at certain conditions)

CALCULATIONS AND EXPRESSION OF RESULTS

- Calculate the average percentage of the replicates and the difference between the highest and the lowest
- Check the tolerance table 5B
- On the certificate report:
  - Number of days
  - Percentages of the different categories of seeds and seedlings
  - Testing methods (including pretreatments)

The percentages of the different categories of seeds and seedlings are rounded to the nearest whole number.

If the sum is not 100 ➔ ROUNDING PROCEDURE

ROUNDING PROCEDURE

After arithmetic rounding the sum is not 100:

A) Round to the whole number the percentage of normal seedlings. Add the integer part of the remaining categories. If the sum is 100, stop.

B) If not, find the value with the greatest decimal part and round it up. If the sum is 100, stop.

Norm.	Abnorm.	Dead
89	5	6
86	7	7
87	8	5
85	6	9
86,75	6,5	6,75
87	6	7

A → 87 | 6 | 6 → **99!**

B ← **100!**

FINAL RESULT

ROUNDING PROCEDURE

In case of equal decimal part, the priority is
c) Abnormal seedlings, hard seeds, fresh seeds, dead seeds

Norm.	Anorm.	Duri	Morti
89	5	2	4
87	4	3	6
87	5	1	7
86	4	1	9
87,25	4,5	1,75	6,5
87	4	2	6
87	5	2	6

A B

C

87	4	2	6

99!

FINAL RESULT

THANK YOU TO:
FABIO FERRARI
ISTA SECRETARIAT

AND YOU FOR YOUR ATTENTION!