Session 4 – The importance of quality seed in agriculture

What is seed quality and how to measure it?

Alison A Powell
University of Aberdeen, UK
Outline

• What is seed quality?
  – What do we want from our seeds?

• Specific aspects of quality
  – Detail
  – How to measure different aspect of quality

• Concluding comments
What do we want from our seeds?

Uniform, successful establishment
What we do not want to see

Weedy crops
Diseased crops

Uneven maturity
Seed quality

• Required variety

• Analytical purity – freedom from weeds, other seed and inert matter

• Good plant establishment

• Freedom from disease
• How can we measure seed quality?

• ISTA seed testing methods
  – Specific aspects of quality
    • Detail
    • How to measure different aspects
Required variety: Variety testing

Two aspects:

1. Identity of the variety: Is the sample the required species or variety?

2. Varietal purity
   - Open pollinated, F1 hybrids
   - Presence of GM in conventional lots and *vice versa*
Traditional methods of variety testing

Morphological methods

Seeds

In laboratory and glasshouse

In the field
Modern methods

- Protein reserves; electrophoresis

- Molecular markers: DNA extraction; PCR
- Microsatellites: Simple Sequence Repeats (SSR)
Methods for GMO detection

• Bioassays

• Biochemical analyses e.g. protein-based

• Molecular methods e.g. DNA-based
Analytical purity

• Avoids weeds and other species

• Methods:
  – Lenses, microscopes, sieves
  – Blowers (light material: chaff, empty florets)
Good establishment

Influenced by 2 aspects of seed quality

Most important: Germination

Can a seed produce a normal seedling?
Normal seedling: can establish in the field
Seed survival curve

High germination, commercial seed

% Germination

Time
Germination tests

Range of media
Germination assessment: Maize

Normal seedlings

Abnormal seedlings
- Coleoptile split >1/3
- Deformed seedlings
- Coleoptile split and spiralled
Rapid assessment of viability:

• Tetrazolium chloride staining:
  – Living tissues stain red
Viable seeds show staining in tissues that must be alive for normal seedling development.

- Living
- Dead
- Heat damage
- Root dead
• But – emergence differences in field conditions

• highly germinable seed lots
Emergence in transplant modules: cabbage
Good establishment

1. Germination
   - high percentage of normal seedlings

2. Vigour
Seed survival curve

Seed lots A, B and C have high germination but differ in physiological age.
Seed vigour tests

Conductivity test (36 hours):
Peas, *Phaseolus* beans

Accelerated ageing test
(72 hours + 8 days germination):
Soyabean
Avoid disease

Seed health tests

• Why are these important?
  – Seed borne inoculum may
    • Cause disease in the crop
    • Introduce disease to new regions
    • Reduce germination and % normal seedlings
  – Testing may indicate need for seed treatments
The test used depends on the organism being tested for and the purpose of the test.

- fungi, bacteria, virus, nematode, insect
- location of inoculum
- sensitivity required
Moisture content

• Seed value set by moisture content

• High moisture content, poor storage potential

• Important in other tests – germination, vigour
Grind → Heat to remove water

Moisture meters
ISTA: Uniformity in seed testing

- ISTA International Rules for Seed Testing
- ISTA Handbooks
- Workshops
- Seminars
- Accreditation
- Proficiency testing
ISTA: Test development

- Technical Committees e.g Germination, 
  - Working groups
- Task Forces e.g GM
- Method validation
- Seed science research
  - Technical Committees
  - Triennial Seed Symposium
  - Seed Science and Technology (ISTA journal)
Concluding comments

Seed quality: Multiple components

– Most important components
  • Cultivar purity
  • Analytical purity
  • Germination

– Other significant components
  • Vigour
  • Seed borne pathogens
  • Moisture content

Measurement of seed quality

– Range of laboratory and field tests
– Uniformity
– Test development is continuous
Acknowledgements

ISTA Colleagues

– Valerie Cockerell: OSTS, Scotland
– Ronnie Don: OSTS, Scotland
– Jose Franca Neto: EMBRAPA, Brazil
– Gillian McLaren: OSTS, Scotland
– Carmen Mortenson: Denmark
– Enrico Noli: LaRAS, Italy
– Giovanni Urso: LaRAS, Italy