

Seeds of success: Getting to know your seeds

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Background

Native grassland restoration is reliant on the supply of good quality seed

Having a basic understanding of the quality of your seeds is essential for maximising the chance of achieving your restoration goals

The cheapest seed is not always best value for money

A basic understanding of germination requirements and dormancy mechanisms also assists in achieving restoration goals

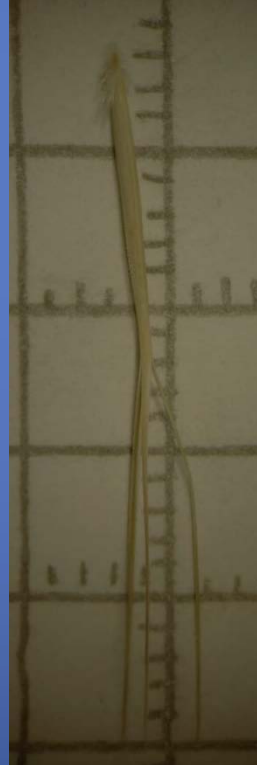


Grass seed morphology

The individual grass seed (caryopsis) is dispersed within a floret. Florets include a palea and lemma, which are highly modified depending on individual species



Rytidosperma caespitosum



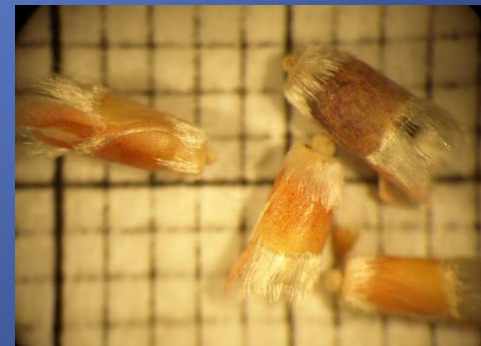
Aristida arida



Panicum mindanaense



Enteropogon acicularis

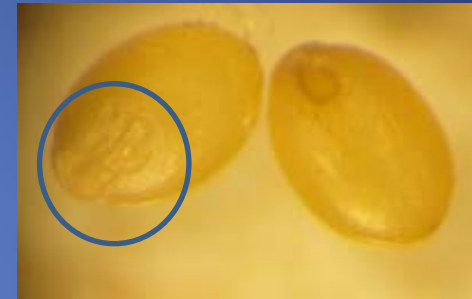


Mnesthia formosa

Grass seed morphology



Rytidosperma caespitosum



Panicum mindanaense



Enteropogon acicularis

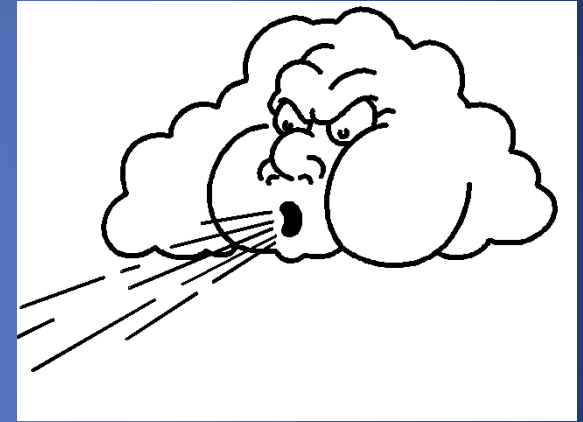
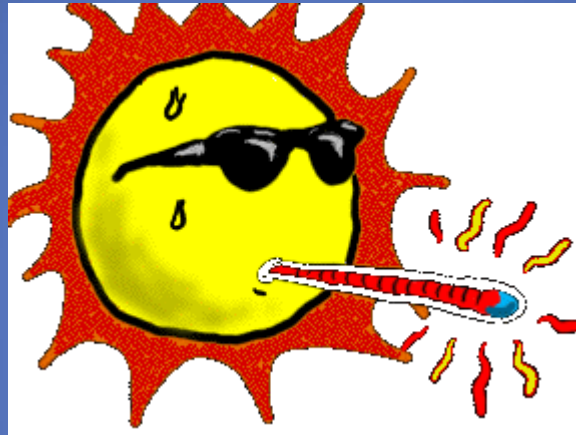


Mnesthia formosa

The embryo is located at one end of the seed, just below the surface

Factors that affect seed quality

1. Environmental conditions during seed development



- This impacts seed size, seed weight, and seed viability

Factors that affect seed quality



2. Collection timing

- A good seed collector should always assess a random sample of seeds to check for maturity and seed fill prior to collecting
- It can be difficult to balance collection timing to maximise seed maturity yet minimise seed loss from natural dispersal (e.g due to windy conditions)
- Collection timing impacts seed size, seed weight, viability and dormancy state (seed maturity)

Factors that affect seed quality

3. Harvest, drying and cleaning techniques



- Various harvest techniques, with differing levels of efficiencies
- Drying is crucial to reduce moisture content and assists in insect management. Seeds may also continue to mature.
- Collections may be cleaned or processed (e.g. mulched) depending on end use and handling ease
- These impact collection purity, viability and seed maturity

Factors that affect seed quality

4. Storage Conditions

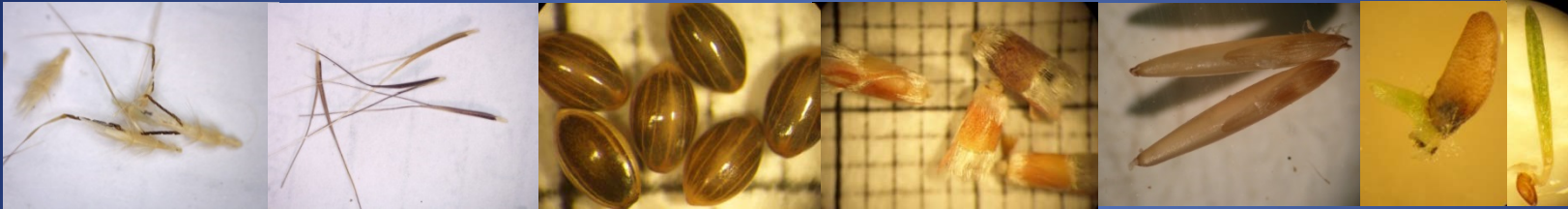


Versus



- Seeds respond to surrounding temperature and moisture levels, should always be stored within controlled conditions
- Storage conditions affect seed health, longevity and dormancy state

Seed quality assessments:



- Seed Counts (Seeds/kg or 1000 seed weight)
- Purity
- Viability

- Value for money
- Testing seeds prior to sowing allows adjustment of sowing rates

- *Also important to assess dormancy state and germination requirements*

Seed Quality Assessments

What is the difference in the quality and value for money for these seed lots?



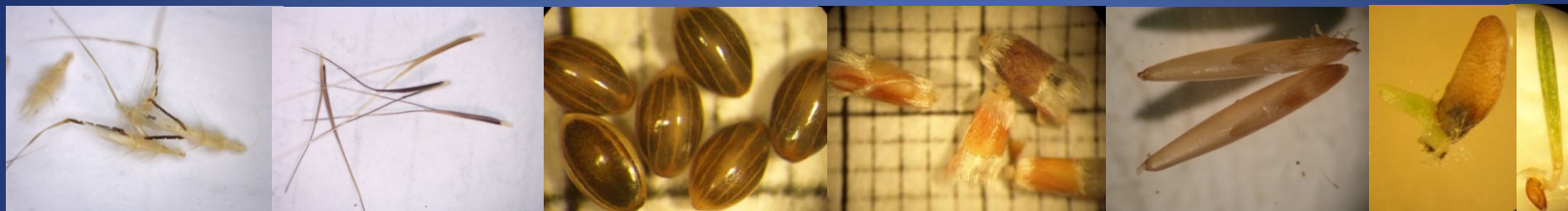
*Enteropogon
acicularis*
(Curly Windmill
Grass)



*Rytidosperma
caespitosum*
(Wallaby Grass)



Seed Quality Assessments



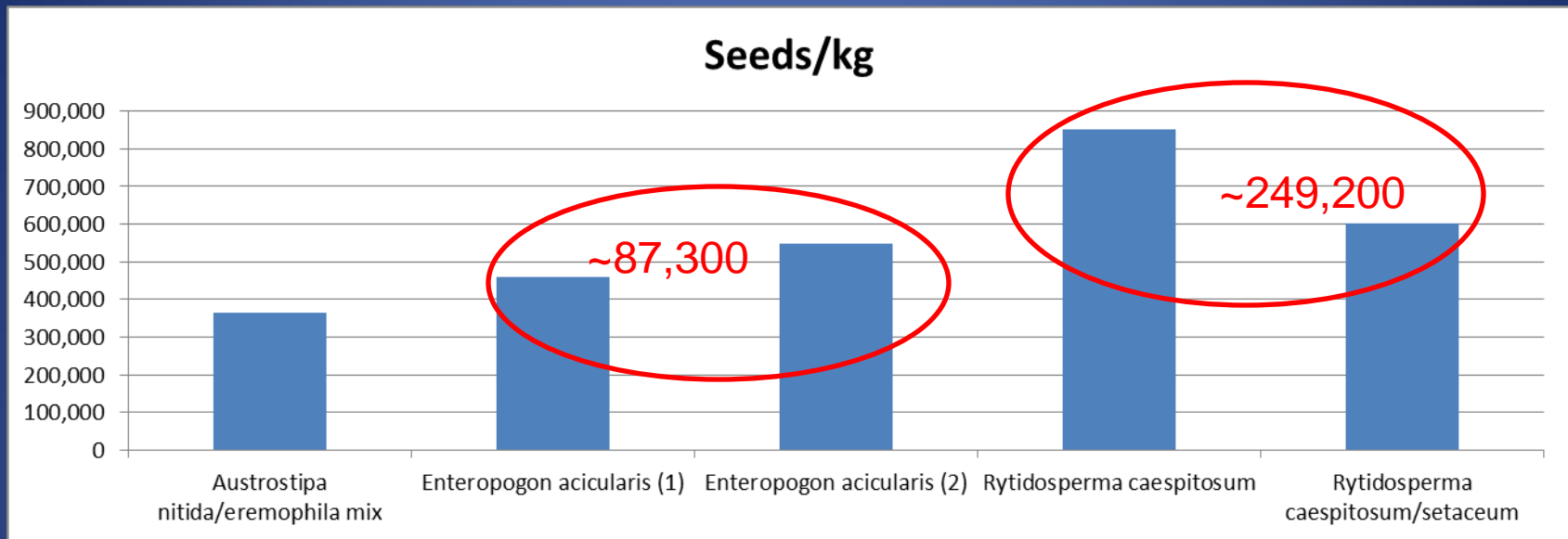
1. Seed Counts and Purity Tests

The size and weight of seeds (or fruit), as well as any impurities present, affect the amount of seed in a given weight. Therefore the seed/kg of individual collections can vary widely.

Impurities can include chaff, leaf, twigs, weed seeds, soil, and insect pests.

While impurities may not have a negative effect on the seeds, they affect volume required for a given amount of seed and value for money.

Seed Count & Purity Tests

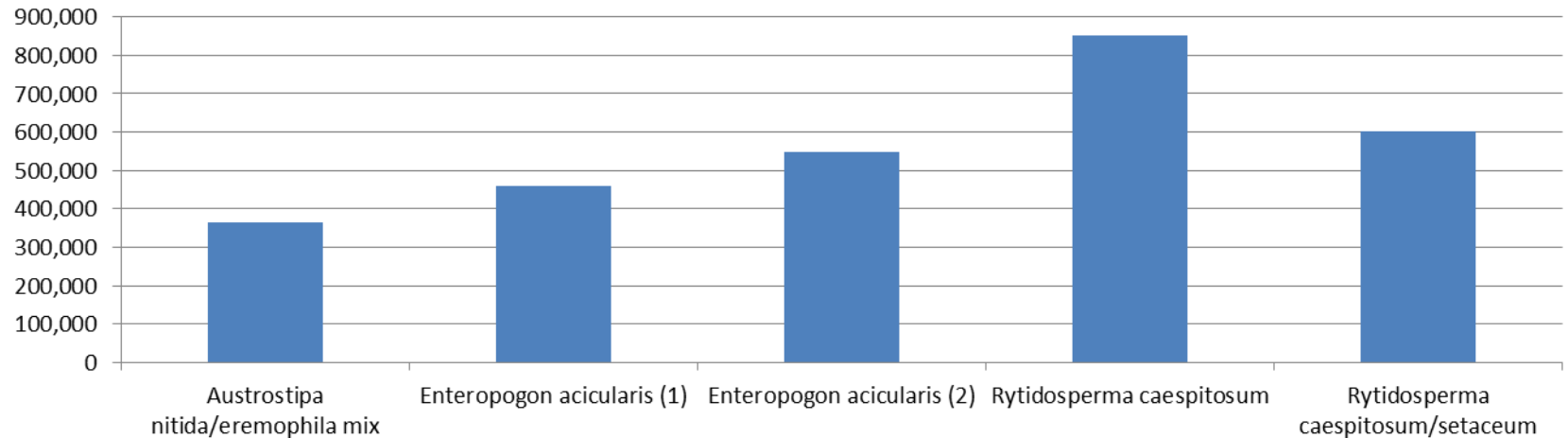


Is purity or viability the main cause for the differences in the seed lots?

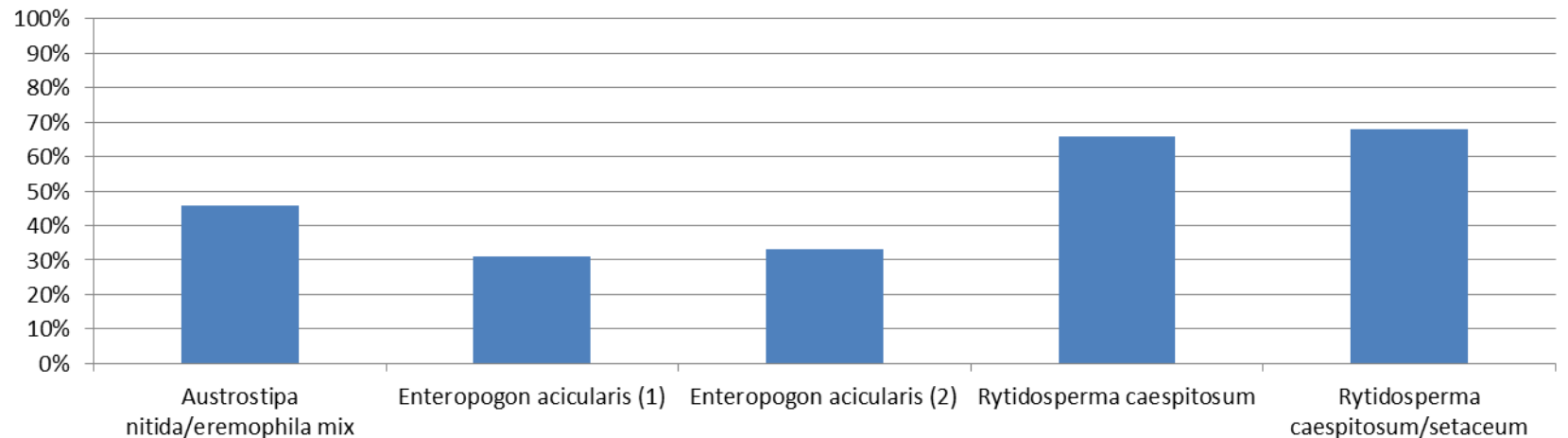
Do not assume that more seeds/kg means better value for money

Seed Count & Purity Tests

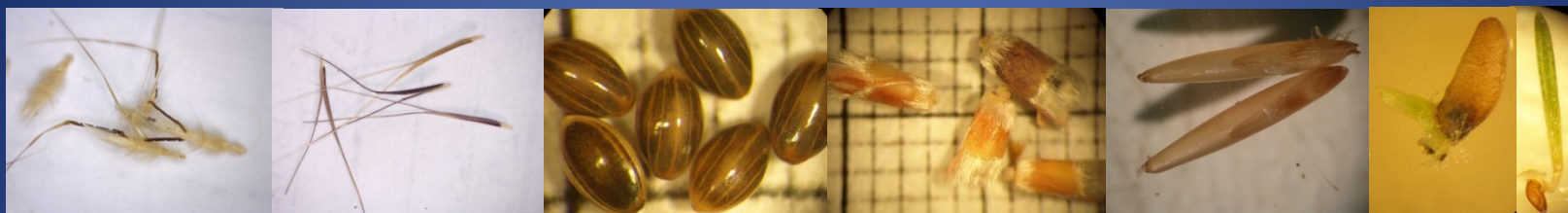
Seeds/kg



Purity



Seed Quality Assessments



2. Viability tests

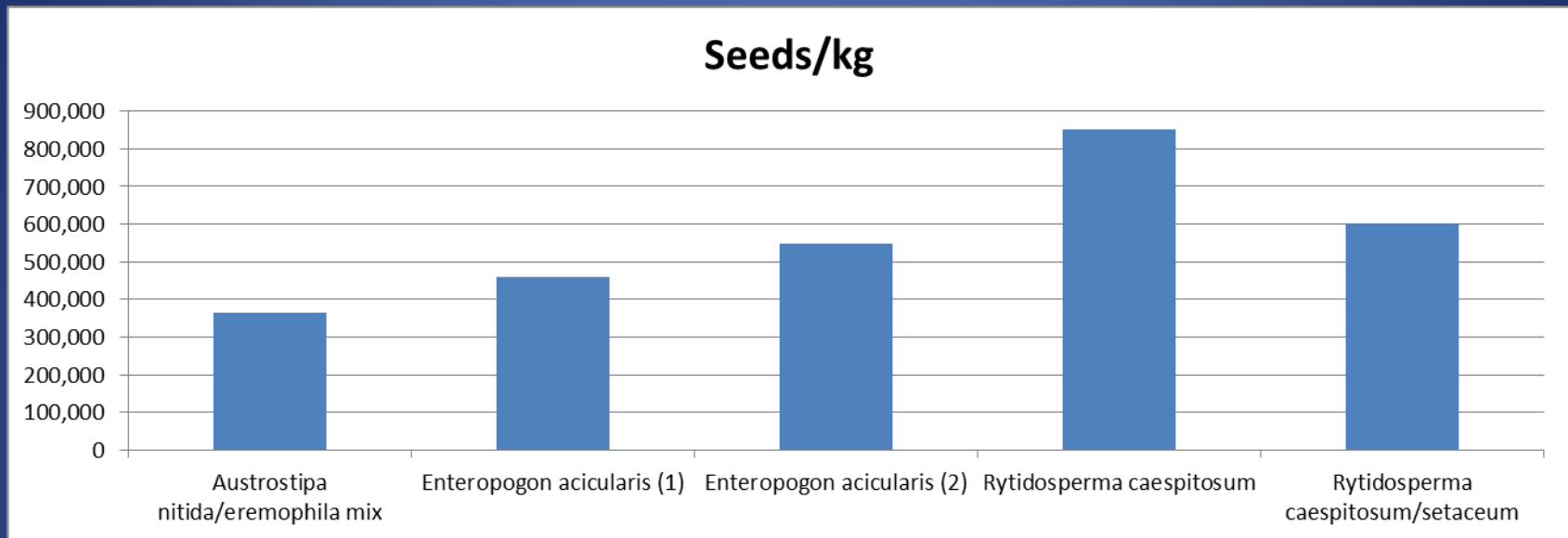
A Viability test should be conducted to assess if the fruit or seed contain an embryo or endosperm (seed fill) and ascertain the health of the embryo or endosperm.

Lack of appropriate developmental conditions, poor health and insect predation all impact viability of seed lots.

Seed viability can be very variable across species and seed lots.

Never assume that all seeds are viable and capable of germination.

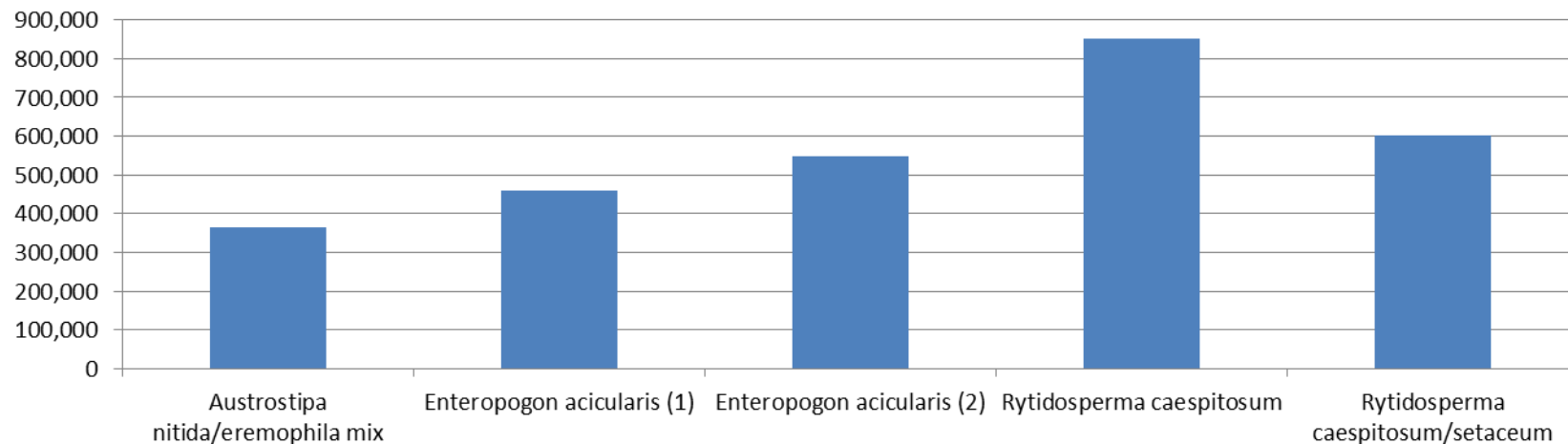
Seed Viability



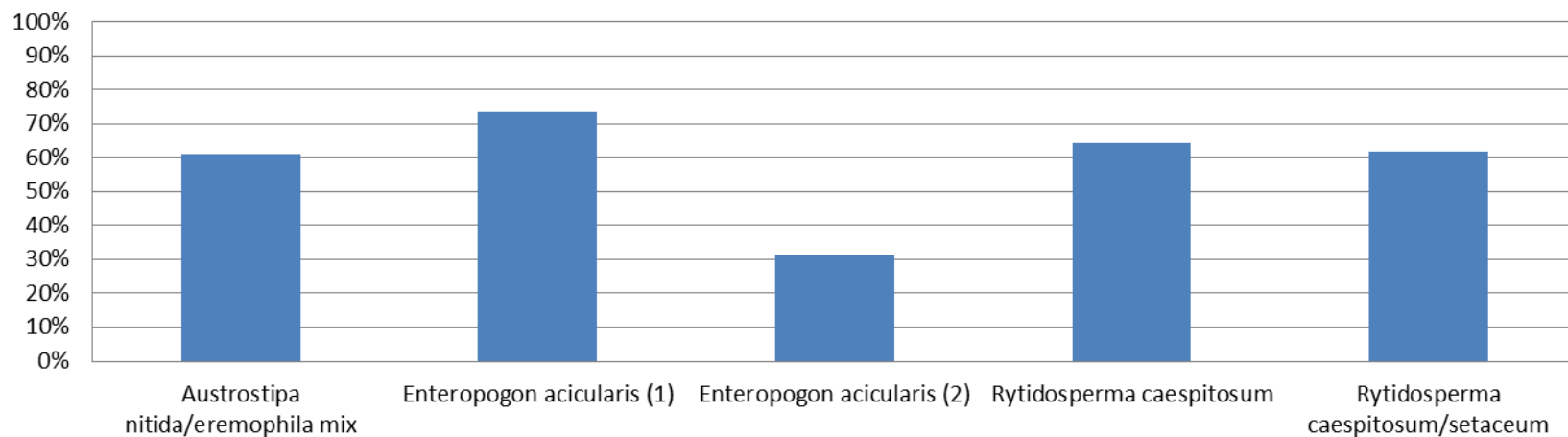
How does viability change these results?

Seed Viability

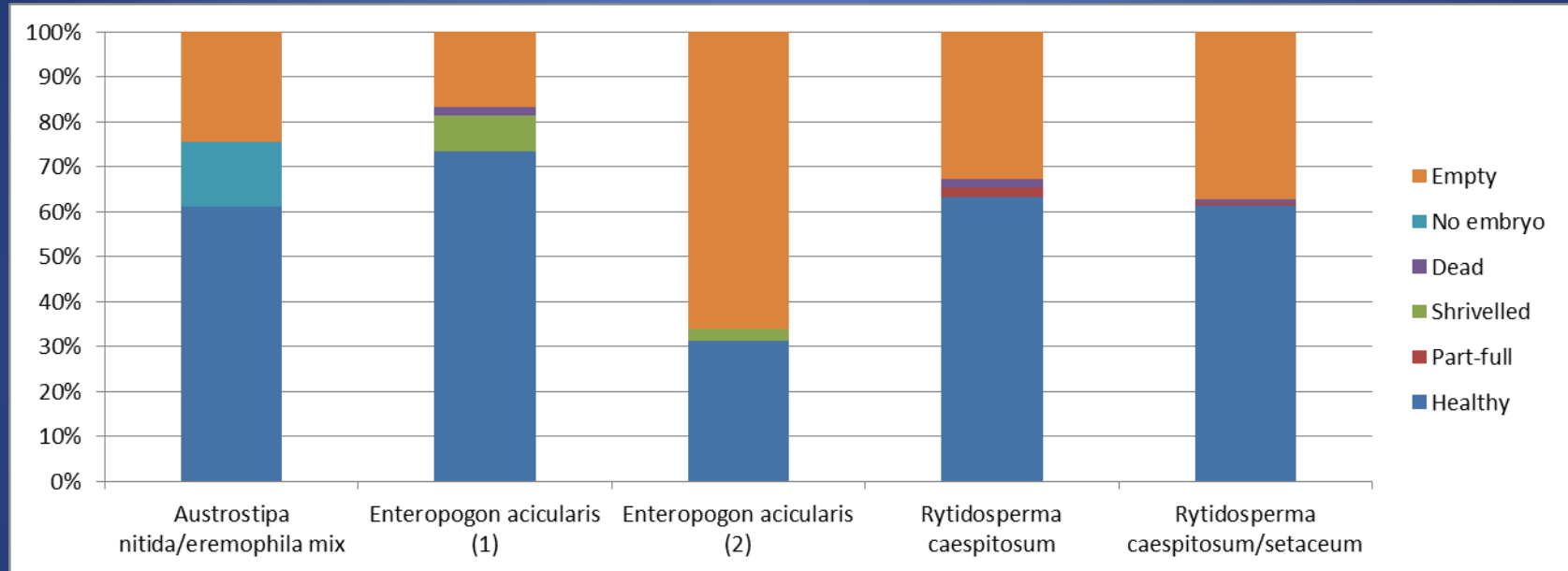
Seeds/kg



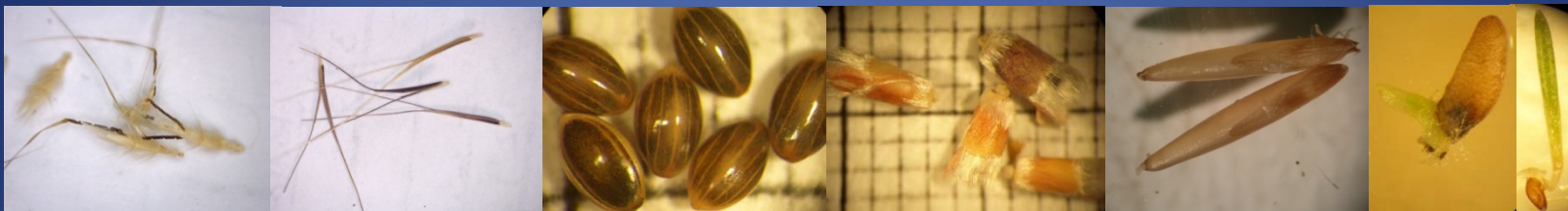
Viability



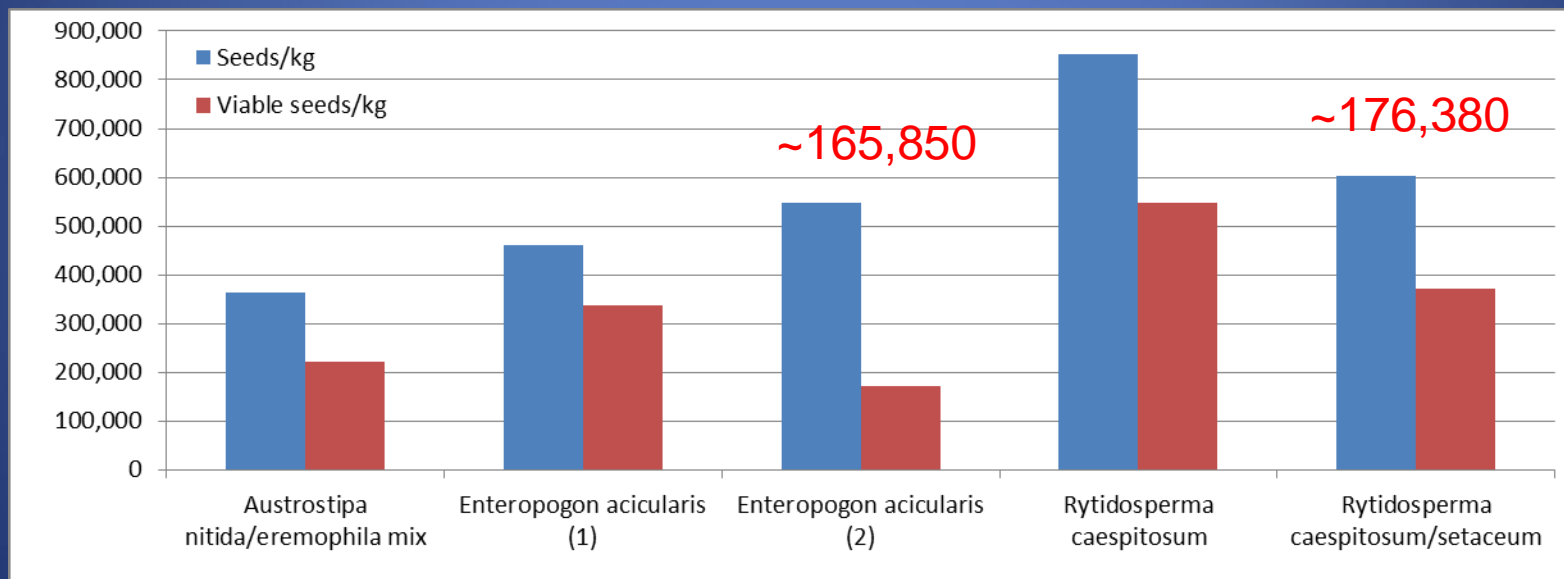
Seed Viability



Seed viability and seeds/kg



- Viable seed (or florets) weigh more than empty florets, therefore assuming that higher seeds/kg is better value for money can be misleading.



- The number of viable seeds/kg might be considered the most important seed quality calculation.

Seed Quality and Value for money

What is the difference in the quality and value for money for these seed lots?



*Enteropogon
acicularis*
(Curly Windmill
Grass)

50kg @ **\$100/kg** = \$5000, ~16,868,000
viable seed



50kg @ **\$80/kg** = \$4000, but only
~8,575,000 seeds. Need 99kg @ **\$7,900**
for same amount of viable seed.



*Rytidosperma
caespitosum*
(Wallaby Grass)

50kg @ **\$350/kg** = \$17,500, ~27,384,000
viable seed



50kg @ **\$350/kg** = \$17,500, but ~18,565,000
seed. Need 74 kg @ **\$25,900** for same
amount of viable seed.

Seed Quality and Value for money



- Seed quality testing is invaluable tool for large restoration projects
- Don't assume lowest \$/kg rates will get you more bang for your buck
- Don't assume that highest seeds/kg is best value...need to use viable/seeds kg
- Conducting quality tests prior to purchase allows you to get the best value for your money and allows sowing rates to more accurately reflect intended restoration goals.

Seed Germination & Dormancy

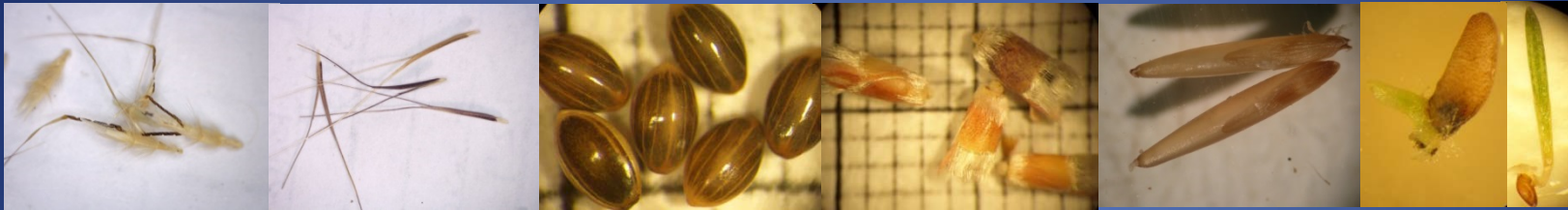


Seed germination should occur when environmental conditions are conducive for sustained survival¹.

Seed dormancy mechanisms are present in ~70% of all flowering of plant species¹.

This prevents germination occurring when environmental conditions appear favourable but chances of sustained survival are poor (e.g., after summer rainfall)¹.

Seed Germination & Dormancy



5 Types of Seed Dormancy:

Physiological PD

Physical PY

Morphological M

Morphophysiological MPD

Combinational C

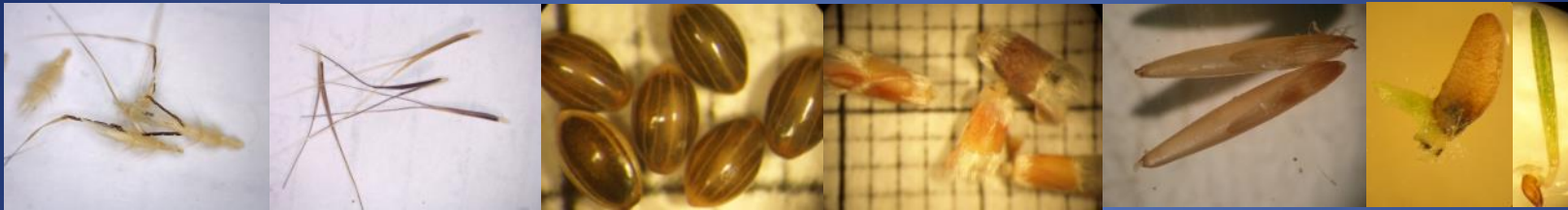
Where present, grasses have physiological dormancy.

Chemicals within the embryo and surrounding tissues suppress embryo growth and prevents radicle emergence¹.

Covering structures such (e.g. palea and lemma) can also restrict radicle emergence.

Seeds can cycle between non-dormancy and dormancy.

Seed Germination & Dormancy



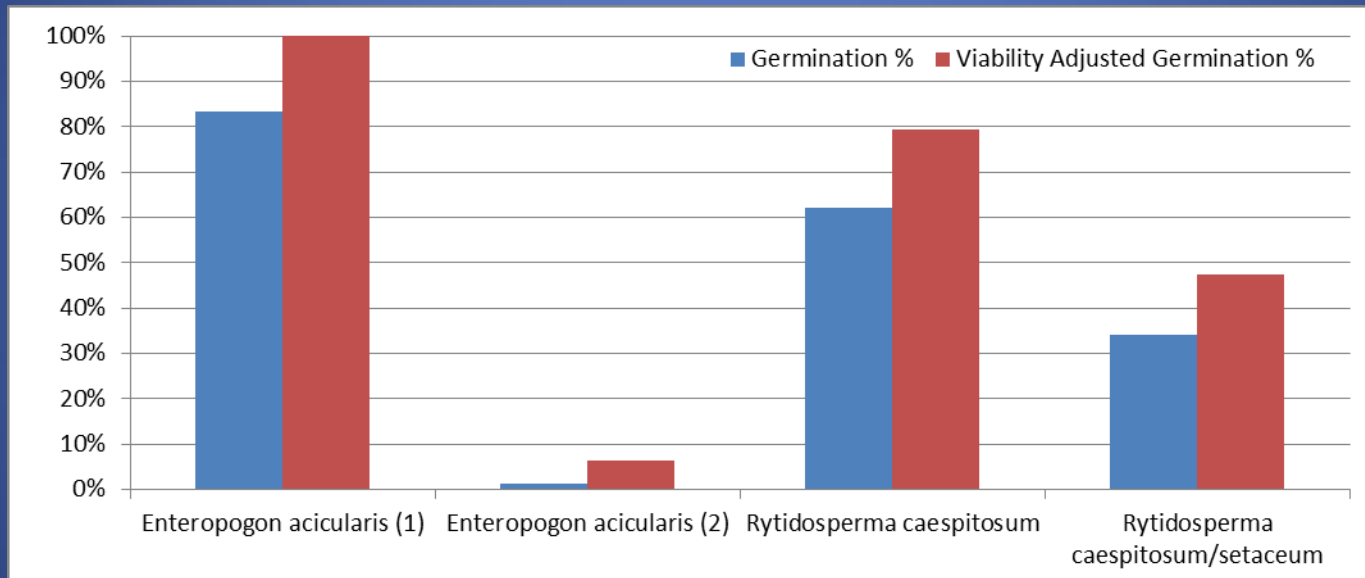
Various ways to overcome PD, including after-ripening in dry storage, removal of covering structures, wet-dry cycling, exposure to growth hormones (GA^3), potassium nitrate and dry heat¹.

Pre-treatments can speed up restoration results but can damage seed, or reduce longevity if field conditions are not conducive for germination.

Seeds can be sown without overcoming PD, BUT need to acknowledge that germination and establishment may be slow.

Seed Germination & Dormancy

The dormancy state of individual collections of the same grass species can also vary according to their maturity at time of collection.



Germination tests should be conducted on fresh seeds. If seed is stored for several months or more, additional tests should be conducted to assess any changes in dormancy state.

Conclusion



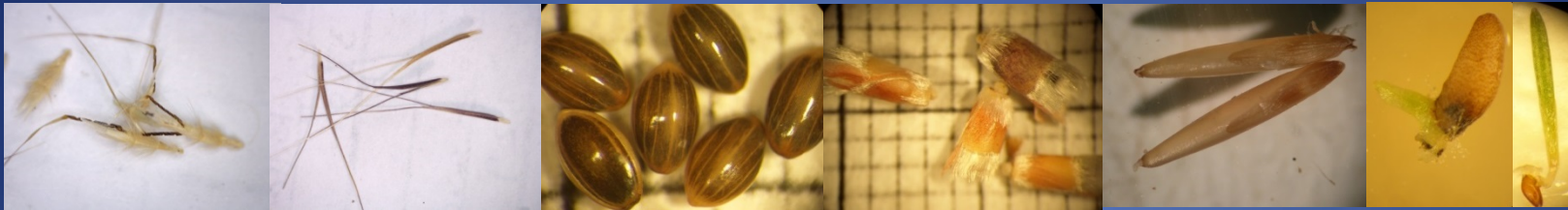
Seed supply forms a major component of native grassland restoration projects.

Seed quality information is critical in determining value for money, sowing requirements and maximising restoration outcomes.

Understanding dormancy mechanisms and germination requirements is also essential for having realistic timeframes for the speed of plant establishment in restoration projects.

Swainsona Environmental Services specialises in seed quality and germination/ dormancy testing. We are happy to assist you to achieve your restoration or rehabilitation outcomes.





Acknowledgements:

- Cristal Mining Australia Ltd.
- Tim Zwiersen, Ecotypic Pty. Ltd.

References:

1 Baskin C.C. Baskin J.M., (2014) Seeds: ecology biogeography, and evolution of dormancy and germination. 2nd Ed. Academic Press, San Diego, California

