MOISTURE ISOTHERM MODELING AND STORAGE BEHAVIOUR OF SEEDS OF CONTRASTING SPECIES

AARHUS
UNIVERSITY
DEPARTMENT OF AGROECOLOGY

DANSEED SYMPOSIUM
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SHABNAM REZAEI
PHD STUDENT

OUTLINE

1 Seed Moisture Content

2 Seed Storage Behaviour

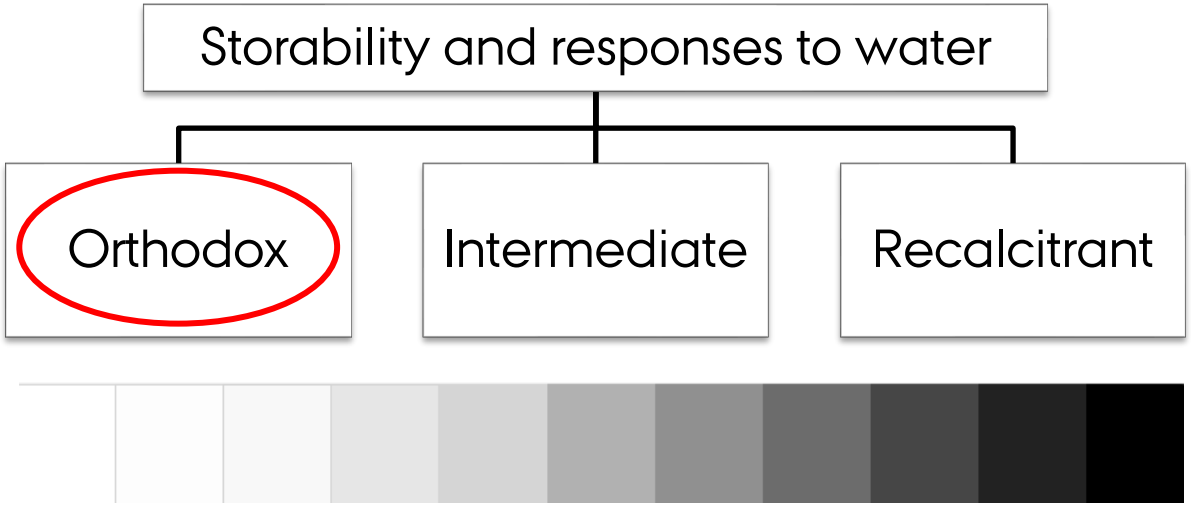
3 Current Research (Methodologies and Results)

4 Conclusions

SEED MOISTURE CONTENT (MC)

- The amount of water in seeds is the most important factor influencing seed quality and storability.
- A small change in seed MC greatly affects the storage life of seeds.
- Generally, if the seed MC increases, storage life decreases.
- If seeds are kept at high MC, the losses could be very rapid due to ageing.
- At very low MC (below 4%), seeds may also be damaged due to extreme desiccation or cause hard seeds in some crops.

SEED STORAGE BEHAVIOUR



Low seed moisture content and low temperature

- Reducing seed MC increases longevity in a **predictable manner** for 90% of species (Roberts 1973).
- Each 1% decrease in seed MC, doubles the life of the seed (Harrington 1972).

SEED STORAGE BEHAVIOUR

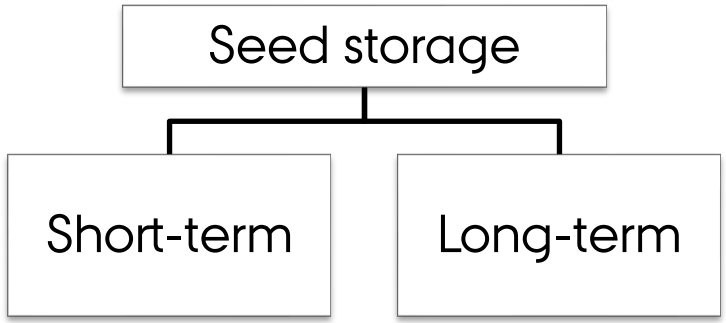
- **Seed longevity** is a measure of how long seeds can be stored and remain viable under a given set of conditions

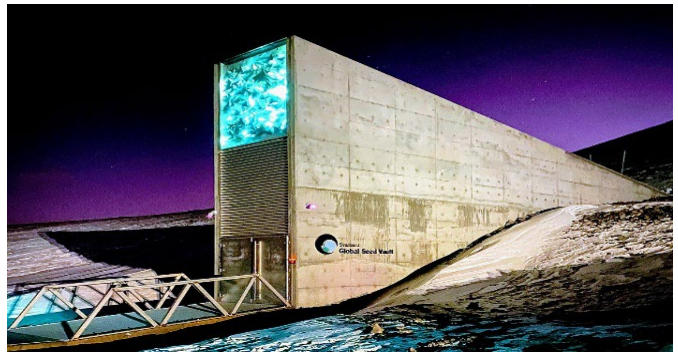
Seed longevity is influenced by:

1. Initial Seed Quality
2. Species/ Variety
3. Moisture Content
4. Temperature




SEED STORAGE BEHAVIOUR





- For longer periods of storage, dried seeds should be stored at –18°C to –20°C (Hong & Ellis 1996).
- However, commercial seed lots are not dried to such low moisture levels, nor are they always hermetically packaged before being sold to consumers.
- Short-term seed storage (<18 months), is usually in commercial seed warehouses conditioned to 30-35% RH and 15-20°C.

Current study:

Studying moisture isotherm cycles and how sorption behaviour influences longevity

STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOUR INFLUENCES LONGEVITY

Background:

- The extent of hysteresis has not been systematically characterized across diverse species.
- Is seed eRH or MC more important for determining seed longevity of de- and adsorbing moisture?

Aims:

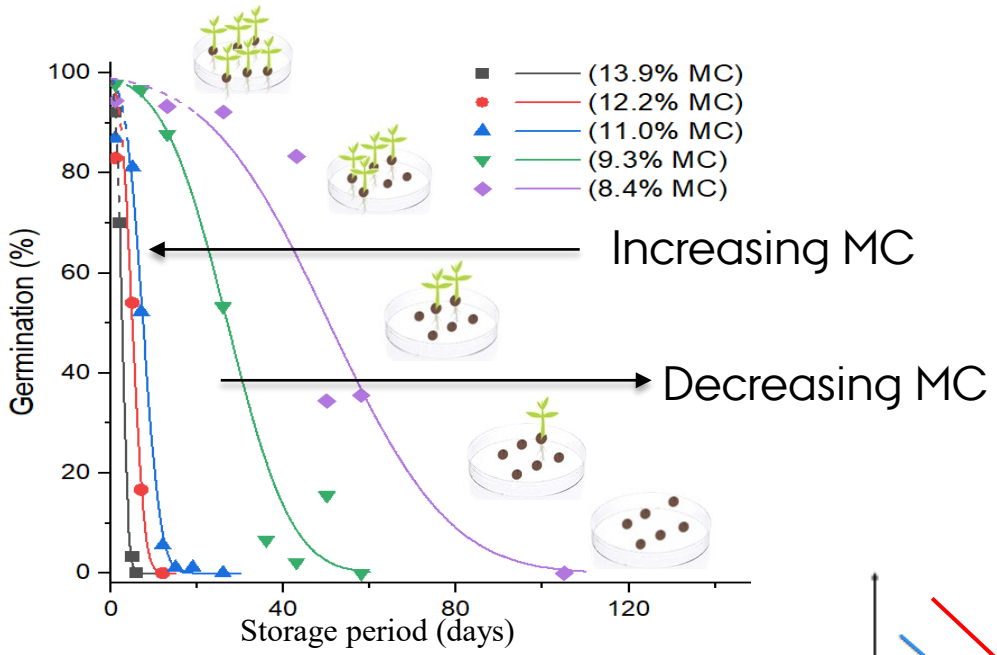
→ To study cycles of moisture desorption and adsorption and their relation to longevity

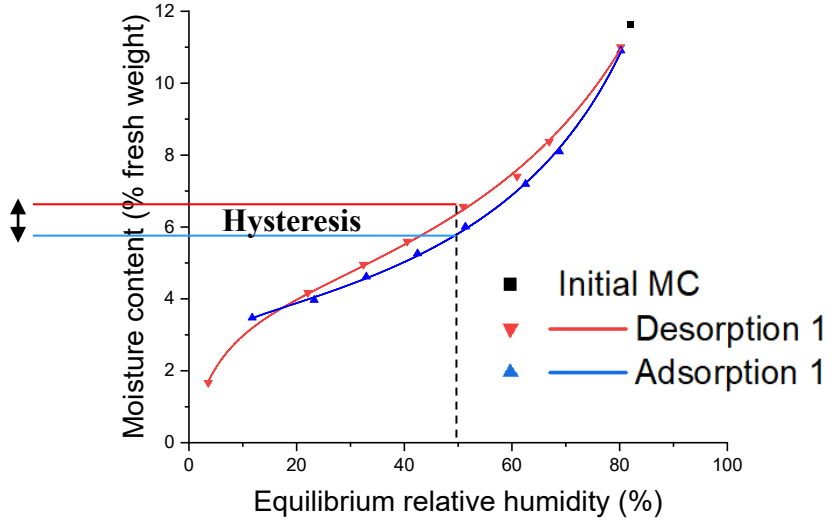
STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOUR INFLUENCES LONGEVITY

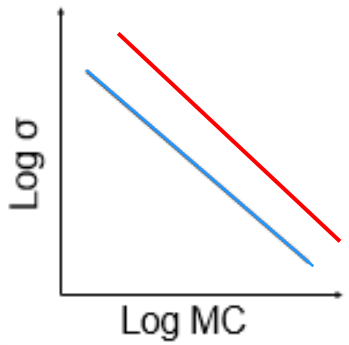
Seed longevity: Two parts of a longevity model

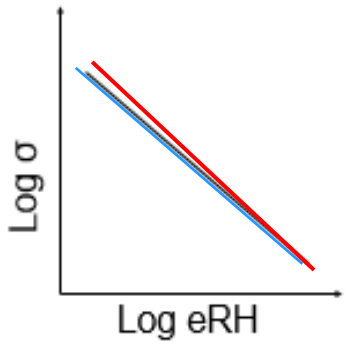
Seed storage experiments: Applying the Ellis and Roberts viability equation

Seed MC and eRH relations: Gugenheim-Anderson-de Boer (GAB) model









STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOUR INFLUENCES LONGEVITY

Materials and Methods:

- Winter oilseed rape

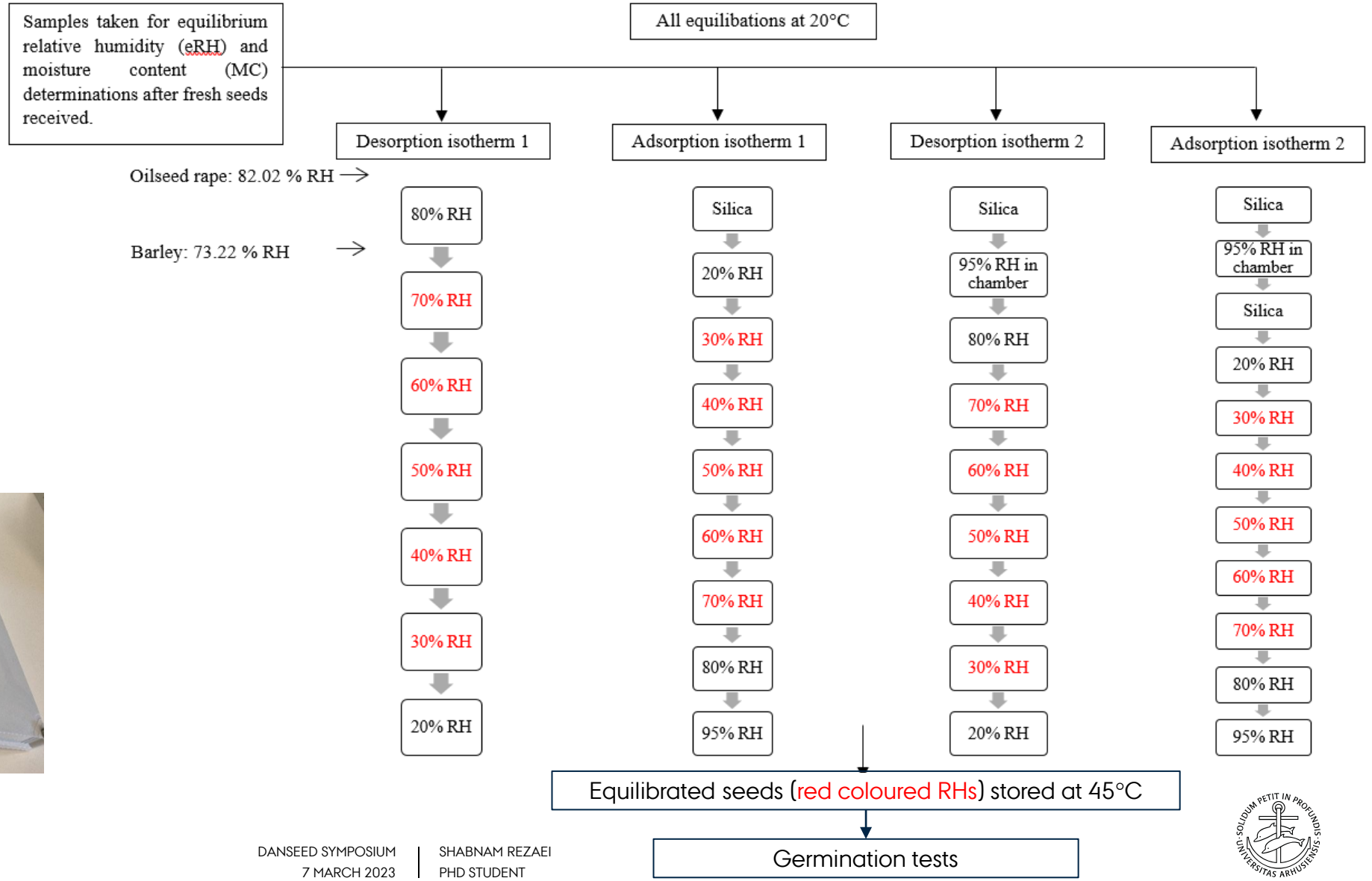
(*Brassica napus* var. DK-Exlibris)

- Spring barley

(*Hordeum vulgare* var. KWS Irina)

LiCl solution boxes

Hay *et al.*, (2008)



STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOR INFLUENCES LONGEVITY

How much do seeds need to dry to shift to the adsorption isotherm?

Materials and Methods:

- Winter oilseed rape (*Brassica napus* var. DK-Exlibris)
- Spring barley (*Hordeum vulgare* var. KWS Irina)

Five cycles, measuring MC and eRH

STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOUR INFLUENCES LONGEVITY

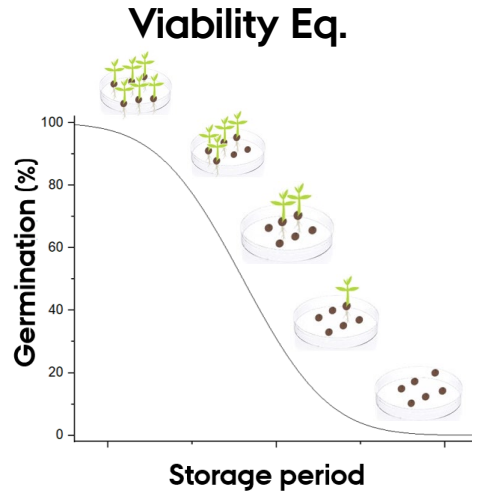
Materials and Methods: Seed storage experiments

Storing seeds at a high MC and 45°C within sealed aluminium foil packets (limited oxygen).

Relative humidity determination

Moisture content determination

45°C



Hay *et al.*, (2019)

STUDYING MOISTURE ISOTHERM CYCLES AND HOW SORPTION BEHAVIOR INFLUENCES LONGEVITY

One-step approach takes into account all the data in estimating the constants *K* and C_W (Hay *et al.*, 2003, 2014) .

$$Y = 100 \times ((PROB(K_i - X/\sigma) + 1)/2)$$

Y=Germination (%)

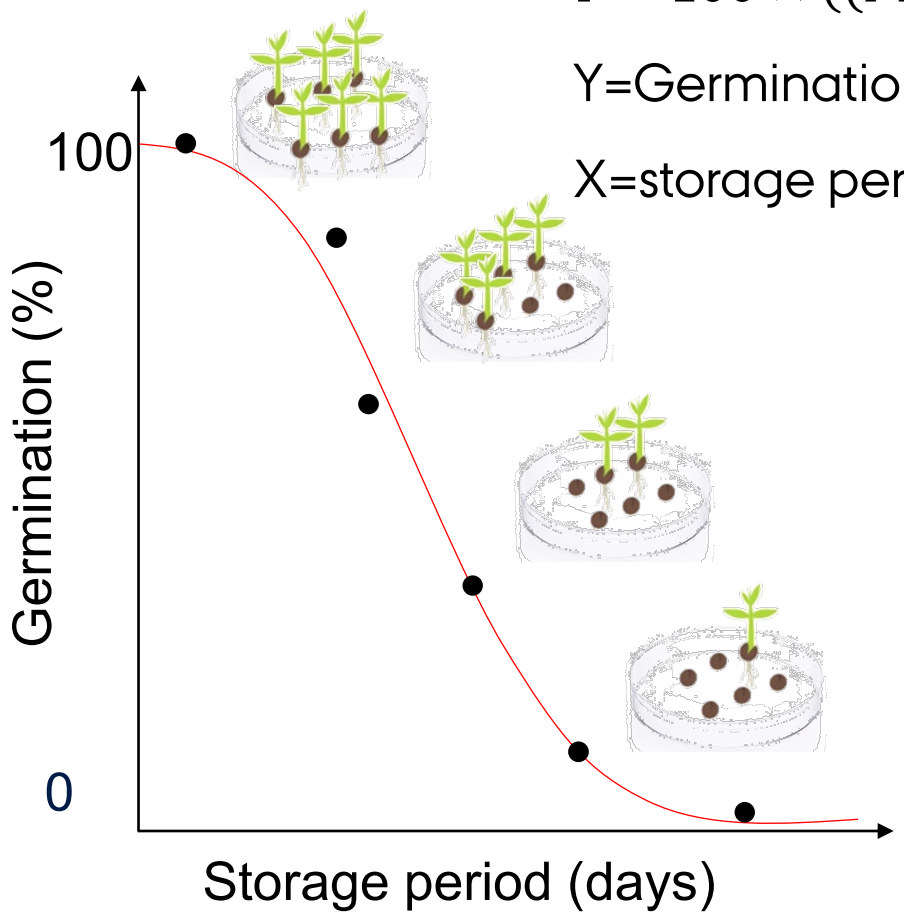
X=storage period (days)

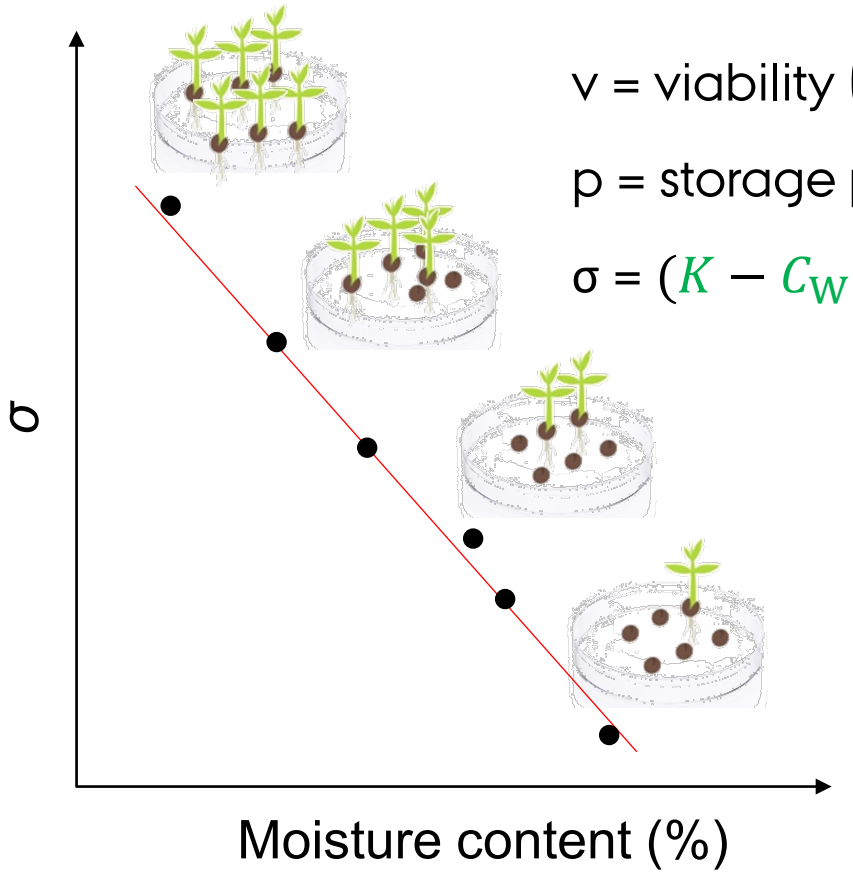
$$v = K_i - {}^{p}/_{10^{(K - C_W \log m)}}$$

v = viability (NED)

p = storage period (days)

σ = $(K - C_W \log m)$ s.d.





RESULTS

Data-analysis are in progress and results will be published as part of PhD-thesis.

CONCLUSIONS

Important to:

1. Assess seed moisture content after seed collection and before seed storage.

2. Consider seed moisture history – whether seeds are desorbing or adsorbing.

3. Consider the differences between seed species for better seed warehouse and seedbank management.

Thanks for your attention!

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