



United States Department of Agriculture

Seed Testing and Storage Recommendations for Tree and Shrub Seed

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by Victor Vankus
USFS National Seed Laboratory



Forest Service

October 2018

Seed Testing and Storage of Tree and Shrub Seed

Factors Influencing Seed Quality

Genetics

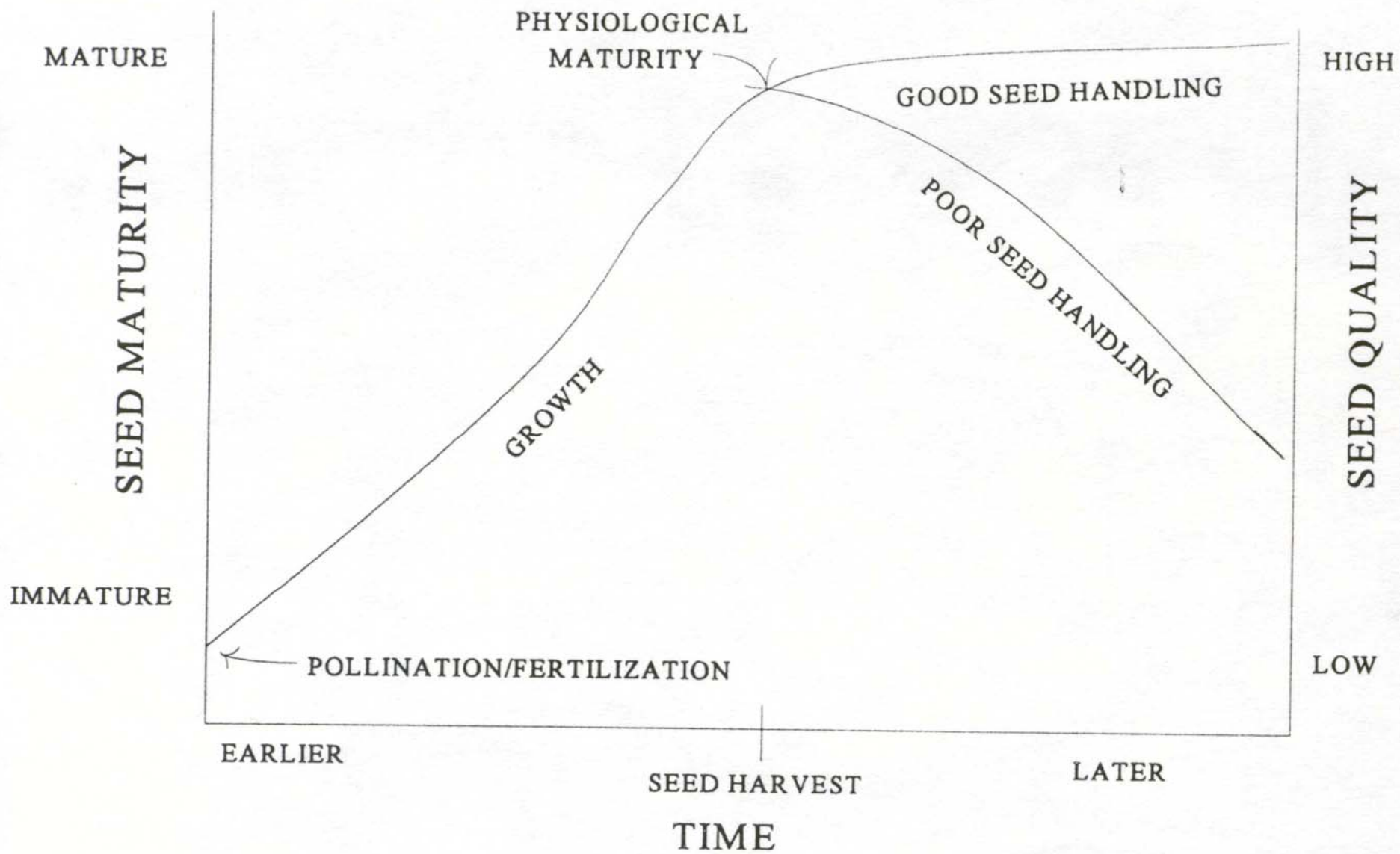
Environmental and Other Conditions from Flowering
through Harvest

Insects and other Pests

Post Harvest Conditions

Seed Collection, Processing, Storage conditions





Seed Testing and Storage of Tree and Shrub Seed

Seed Testing

Conducted to assess the condition of a seed lot at that point in time.

Test results guide our actions for handling and managing seed collections.

- Do we collect these seeds?
- Do we keep these seeds?
- What are the physical components and number of seed?
- What is the viability and moisture status?

Is the seed lot in the desired condition for storage?



Seed Testing and Storage of Tree and Shrub Seed

Types of Seed Tests

Purity

Seed Count

Viability

x-ray, germination, tetrazolium, excised embryo

Moisture

moisture content, equilibrium relative humidity (ERH)

Association of Official Seed Analysts (AOSA)

International Seed Testing Association (ISTA)



Seed Testing and Storage of Tree and Shrub Seed

Purity Test

Physical purity – determination of the percent by weight of pure seed in the lot.

Components identified

Pure seeds (specific definitions of pure seed units according to the “Rules for Testing Seeds” by the Association of Official Seed Analysts)

Inert mater (dirt, sticks, broken seed,)

Other seeds

Crops, Weeds





www.nps.gov/plants/sos/bendcollections

Seed Testing and Storage of Tree and Shrub Seed

Purity Test

Storage collection should contain pure seed and as little inert material as practical to obtain through cleaning.

Other seeds and inert material may contain water and can significantly increase the volume of the collection to be stored.

Purity test results can be used to manage seed harvest practices, initial seed processing, and to determine whether additional cleaning is required.





Seed Testing and Storage of Tree and Shrub Seed

Seed Count

Determined on pure seed.

Number of seeds per pound.

Required to determine pure live seed (PLS) per pound.







The Role of Seed Analysis in Genetic Conservation

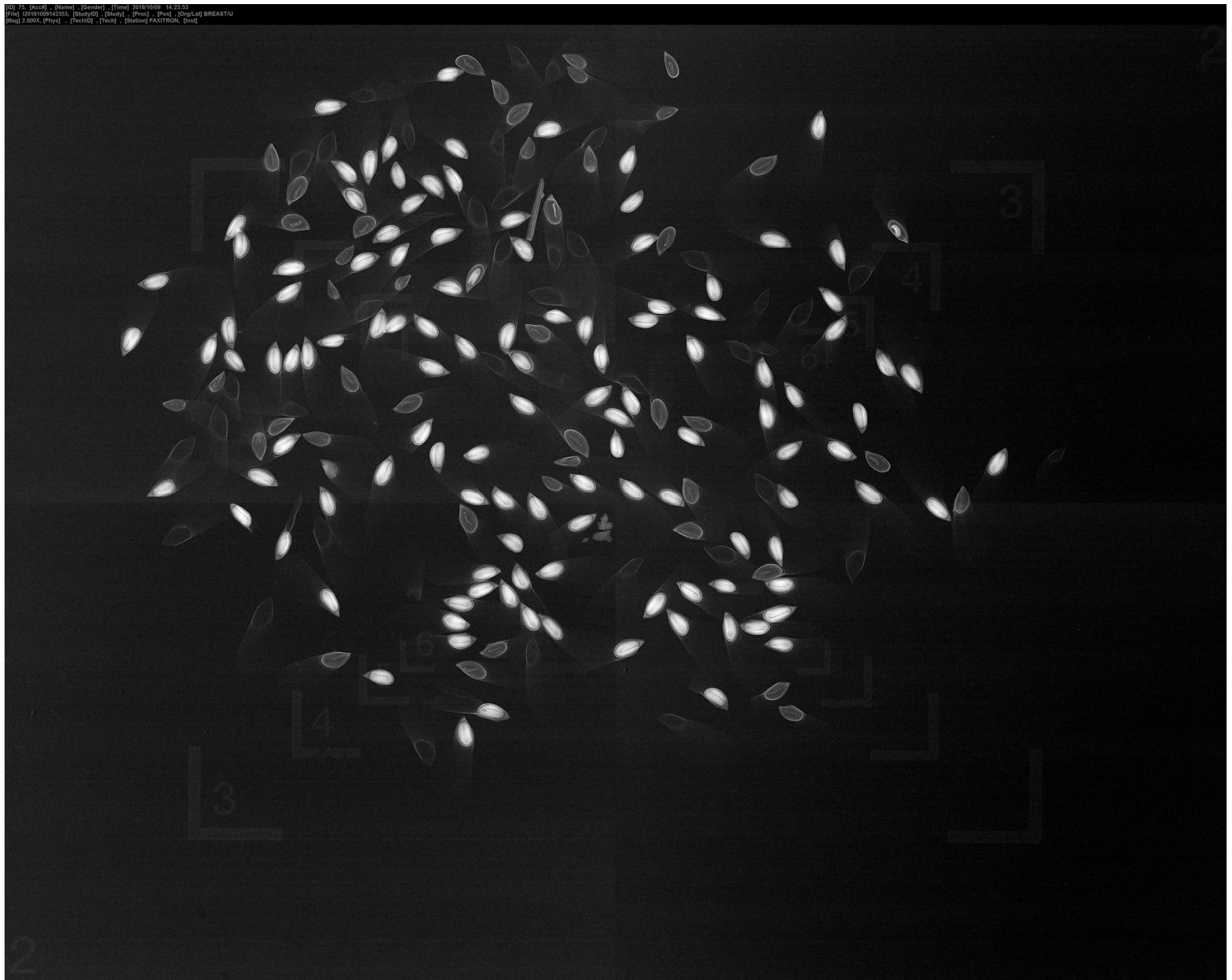
Viability Testing – X-ray

Examine the condition of a seed lot quickly and accurately.

Non destructive.

May not be a good estimate of germination.





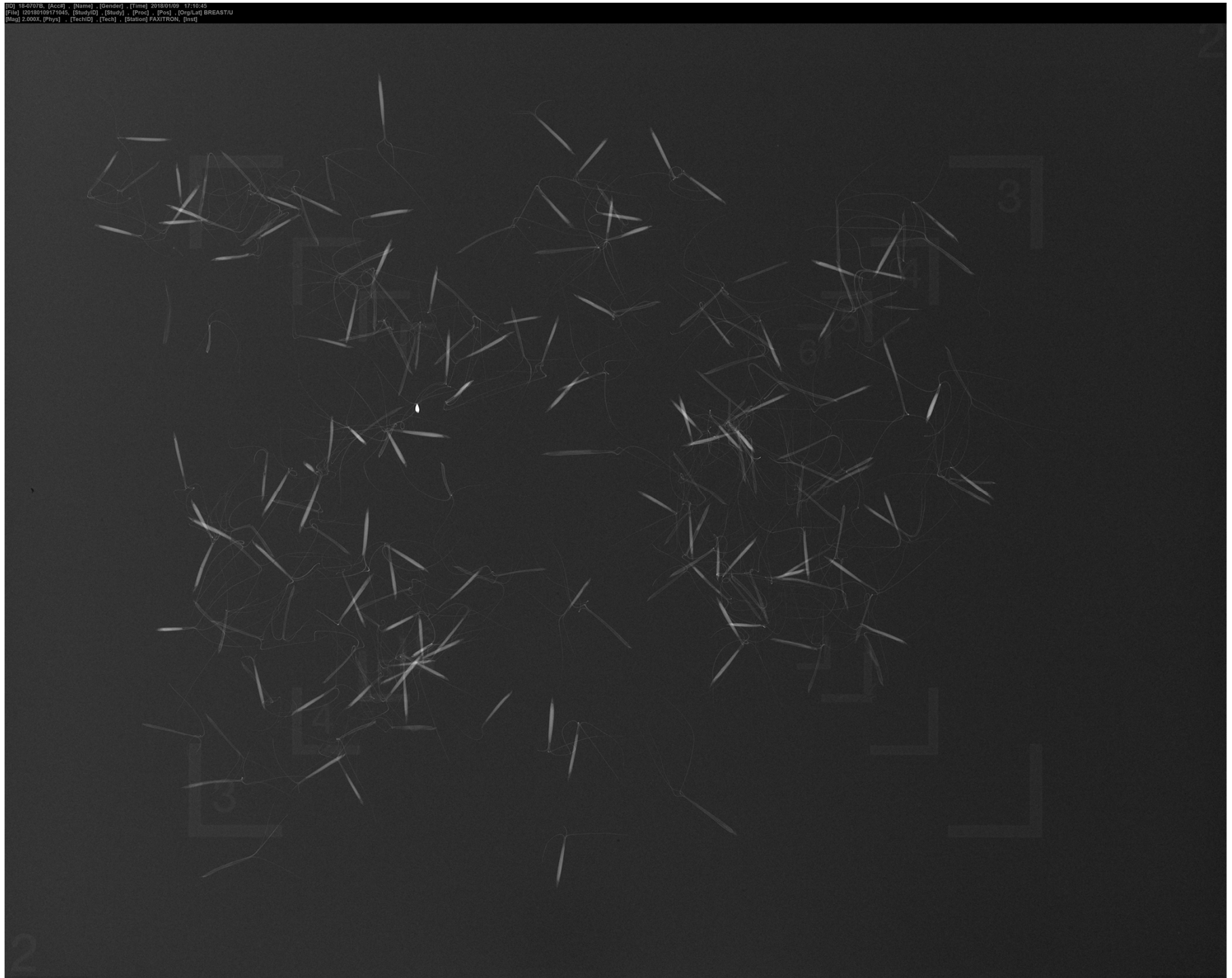
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[Mag] 1.500X, [Phys] , [TechID] , [Tech] , [Station] FAXITRON, [Inst]







Seed Testing and Storage of Tree and Shrub Seed

Viability Testing - Tetrazolium

Chemical test - tetrazolium salt reacts with enzymes inside the seed to stain living tissue red.

Relatively quick vs. germination.

Dormant seed

Determine viable dormant seed at the end of a germination test - Independent of dormancy (usually).

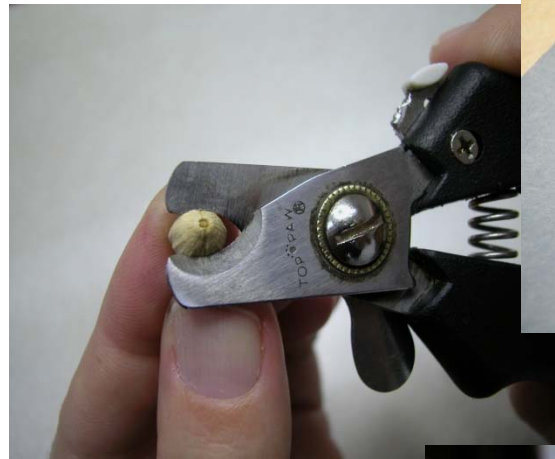
Only alternative to quickly estimate viability for many species.

Requires training and experience to accurately estimate viability.



Preparation for Staining

Expose the Tissue

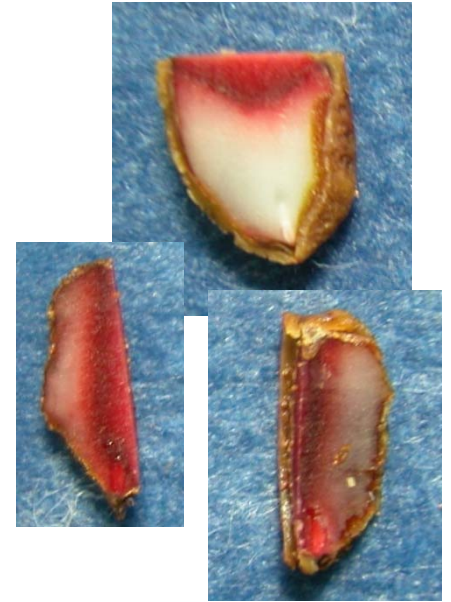


Evaluation

Staining patterns

Turgidity

Essential structures



Seed Testing and Storage of Tree and Shrub Seed

Viability Testing – Excised Embryo Test

Embryo removed from the seed and is free from the seed coat and nutritive tissue.

Relatively quick vs. germination

Analyze embryo characteristics and growth.

Closer to germination test - less subjective than tz.







Seed Testing and Storage of Tree and Shrub Seed

Viability Testing – Germination

Precise conditions for temperature, light, media, pretreatments, reporting. Standardized rules for many species.

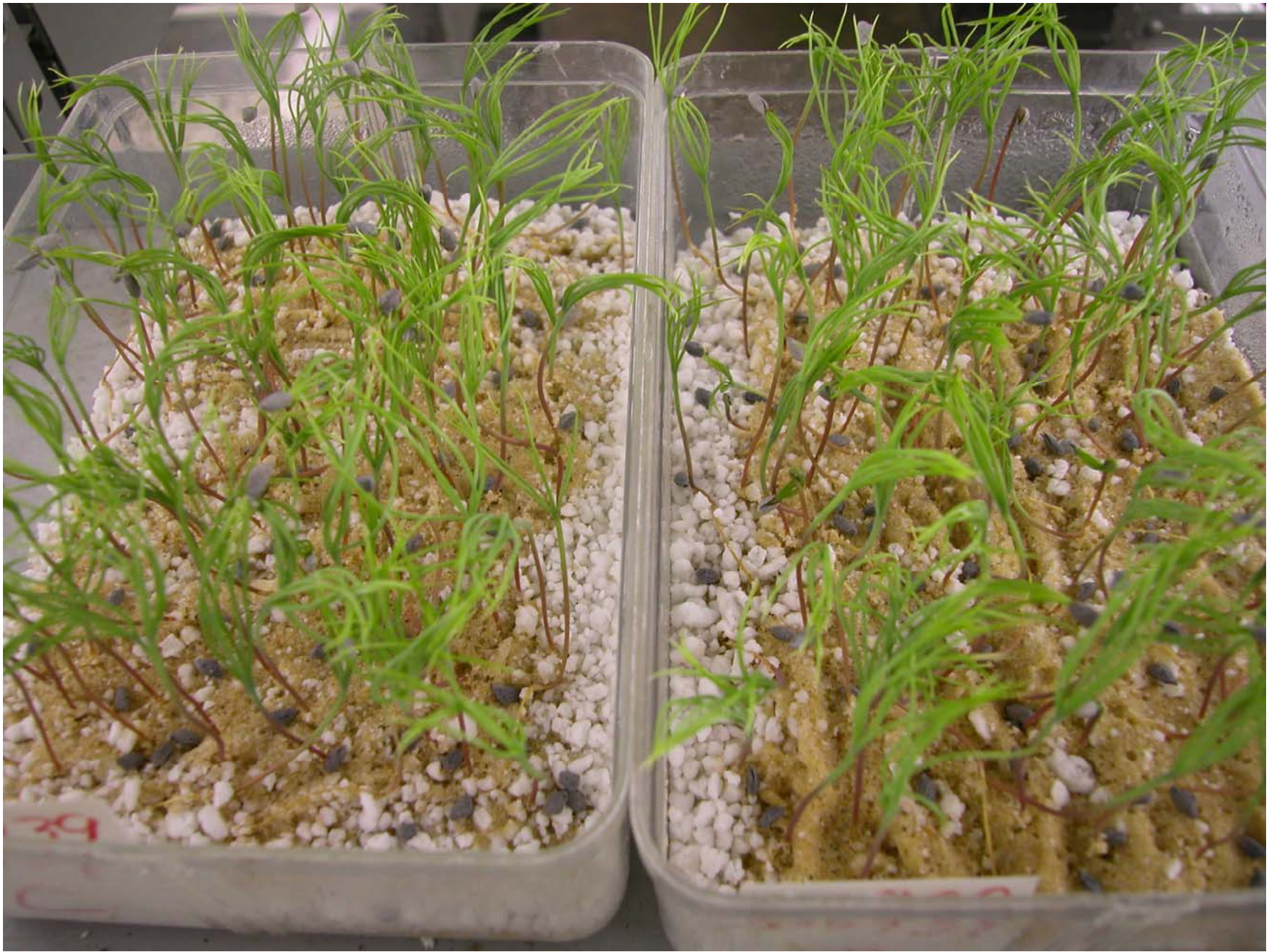
Determine the maximum number of seeds that will produce a normal seedling.

Repeatable results









Seed Testing and Storage of Tree and Shrub Seed

Moisture Testing

Regulating seed moisture is the most important factor in preserving seed viability.

How much water is in the seed?

Are the seeds metabolically active? Respiring?

Is it safe to freeze the seed for storage?



Moisture content thresholds and potential effects on stored seeds of most species

<u>Percent</u>	<u>Effects</u>
>30	Germination begins
18 to 20	Overheating from respiration in storage
10 to 18	Seed fungi become active
>9	Insect activity
4 to 8	Best range for sealed storage
<4	Desiccation damage possible in some species



Seed Testing and Storage of Tree and Shrub Seed

Equilibrium Relative Humidity (ERH)

Monitors Seed Moisture

How much water is in the seed?

Are the seeds metabolically active? Respiring?

Is it safe to freeze the seed for storage?



Probe

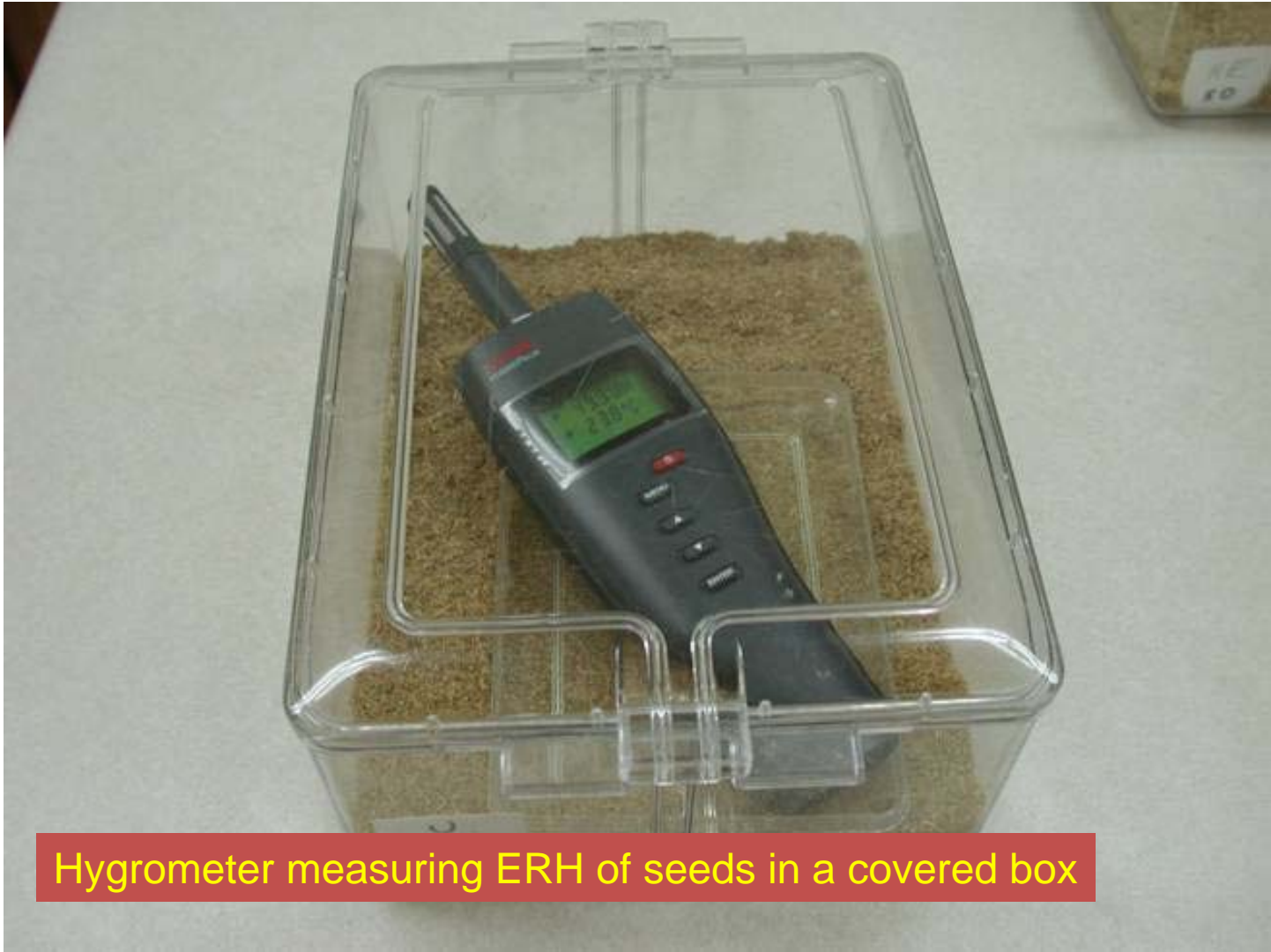
Sample holder

A water activity (A_w)
meter used to measure ERH.

Meter

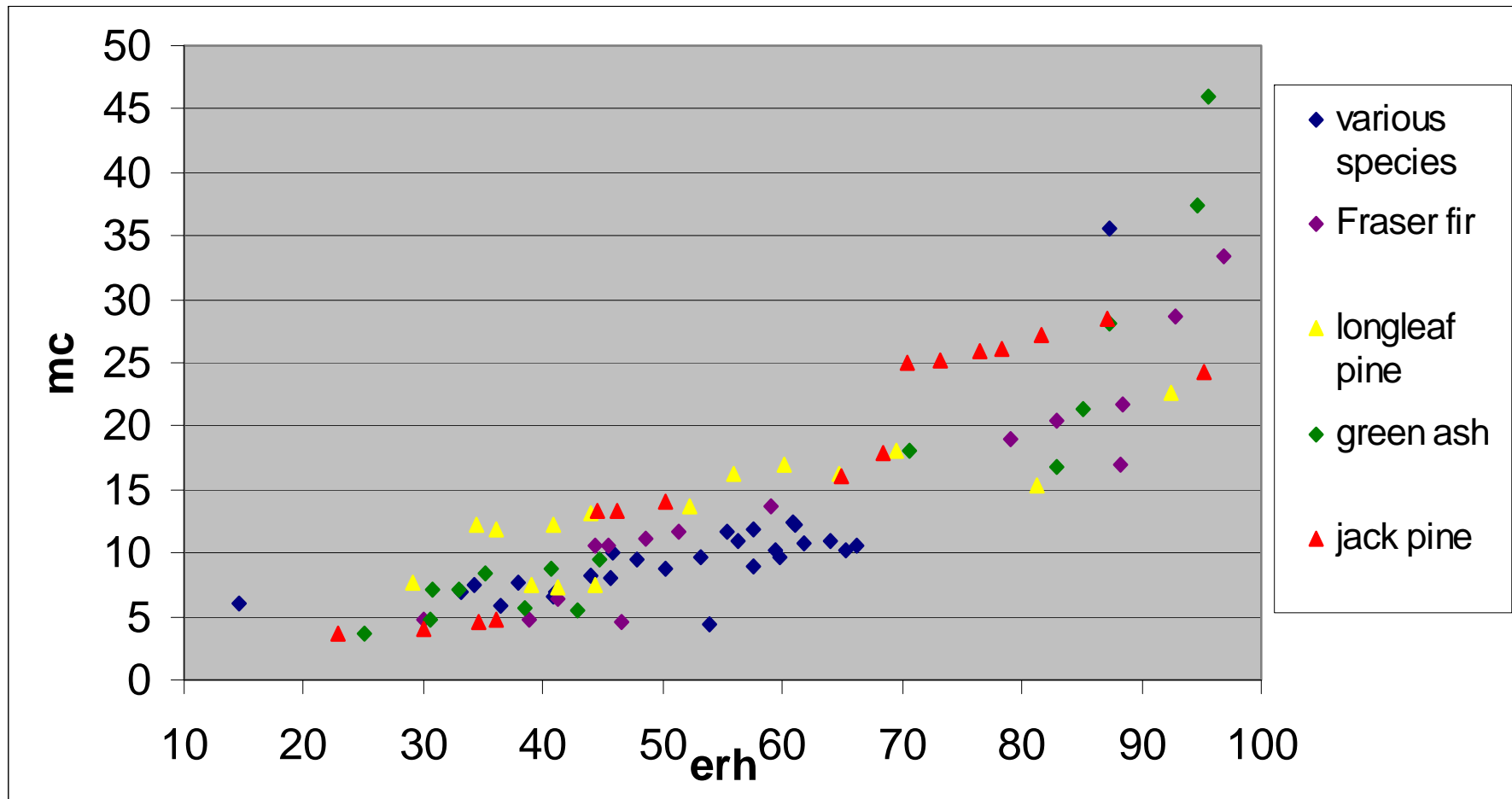
Water
Activity
Meter





Hygrometer measuring ERH of seeds in a covered box

Equilibrium Relative Humidity vs. Moisture Content



Seed Testing and Storage of Tree and Shrub Seed

Key points of ERH

- Water Activity is another term that is used for ERH
- Can be used on any seed lot regardless of
 - Viability
 - Purity
 - Stage of extraction
 - Species
- No conversion charts needed
- Traceable standards available for calibration
- Non destructive
- Fast – Results obtained in a few minutes
- Very easy to use
- Low cost equipment (\$200 to \$2500)



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Seed Testing and Storage of Tree and Shrub Seed

Factors Influencing Seed Quality

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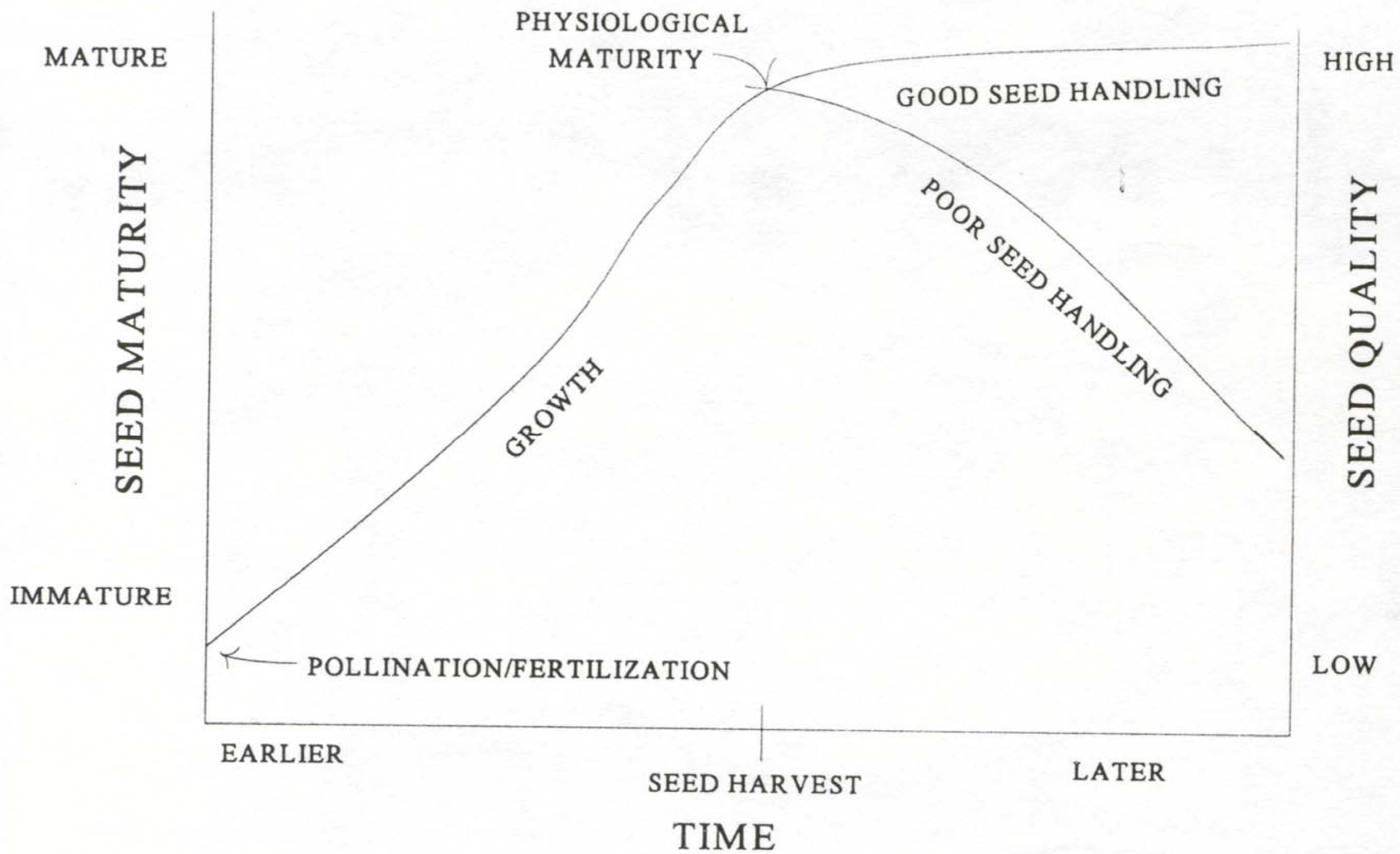
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Seed Testing and Storage of Tree and Shrub Seed

Seed Storage

Factors Affecting Viability and Longevity of Seed in Storage

- Seed maturity
- Genetics
- Year – annual effects
- Physical damage – processing
- Physiological deterioration – handling, transport, mc
- Fungi and insects
- Initial viability



Seed Testing and Storage of Tree and Shrub Seed

Seed Storage

Is the seed lot in the desired condition for storage?

- Moisture content

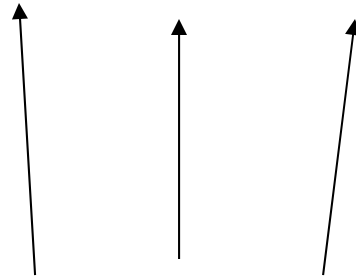
Are the storage conditions appropriate?

- Temperature
- Humidity
- Air exchange
- Packaging/Container



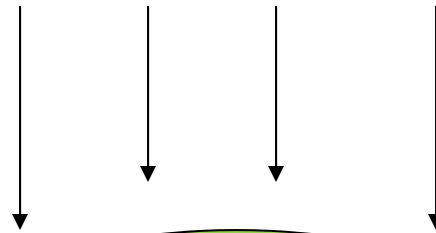
Dry air (Relative humidity is below 30%)

Water leaves the seed and goes into the dry air.



Moist seed

Humid air (relative humidity is above 30%)



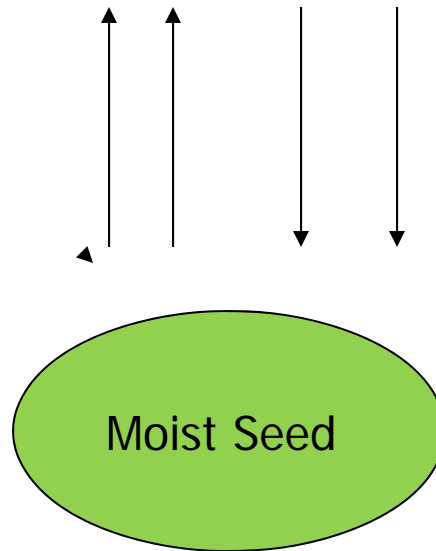
Water moves from the air into the dry seed.

Dry seed

To keep seeds dry they must be sealed in a moisture proof container.

Humid air (70%)

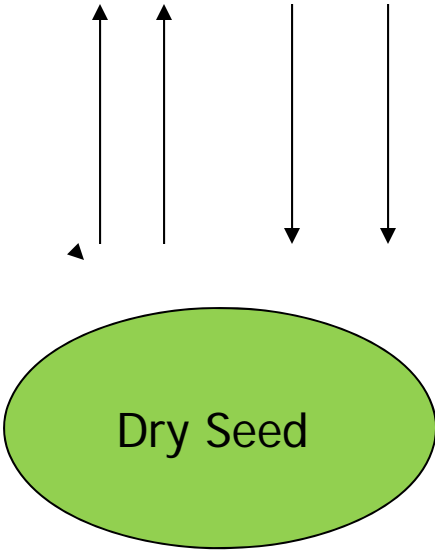
Water
moves
both ways
or not at
all.



The condition of a high equilibrium relative humidity. At equilibrium this seed will measure an ERH of 70%.

Dry air (25% relative humidity)

Water
moves
both ways
or not at
all.



The condition of a low equilibrium relative humidity. At equilibrium this seed will measure an ERH of 25%.

Seed Testing and Storage of Tree and Shrub Seed

Scheduling Seed Tests

Throughout collection and processing as needed.

After processing and prior to storage.

During storage - Monitor moisture and viability
over time

Prior to sowing or grow out – check viability





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USDA Forest Service National Seed Laboratory

www.fsnsi.fs.fed.us



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