Plant Propagation PLS 3223/5222

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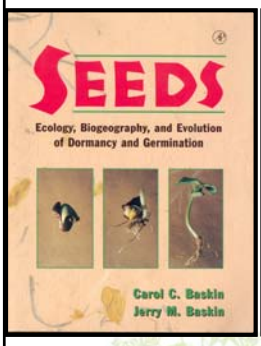
Techniques of Seed Production and Handling

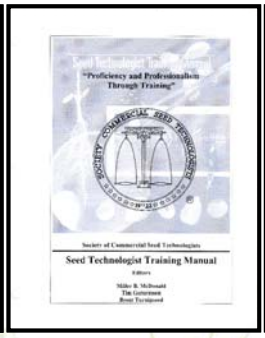
Chapter 6

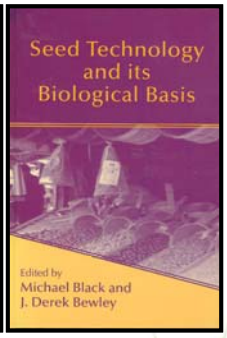
Chapter 6 Objectives are to Understand:

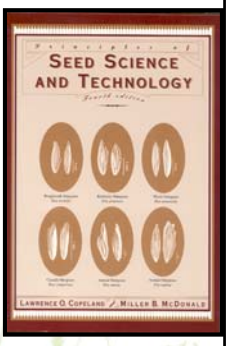
1. • Different sources for seeds
2. • Harvesting and processing seed
3. • Seed tests
4. • Seed treatments to improve germination
5. • Seed storage

Excellent Seed References









Specialized Seed Companies

- Improved cultivars and varieties
- Need for genetic purity in seed lots
- Grower expectation for high quality seed with improved germination
- The development of specialized seed cleaning equipment and handling
- Development of pre-planting seed treatments

Commercial Seed Production

Activity	Objective
Genetic selection	Develop superior varieties
Seed production	High yield and quality
Seed collection	Maximize yield at optimum stages
Seed conditioning	Separate seed
Seed treatments	Enhance germination or facilitate sowing
Packaging & storage	Retain seed quality

Table 6-1: Hartmann et al., 2011

Considerations for Seed Production Sites

- Appropriate soil type and fertility
- Cropping history
- Adequate soil moisture
- Dry environment during harvest
- Ability to isolate open or cross-pollinated crops
- Space for suitable planting density
- Pest control
- Availability of insect pollinators

Harvest Maturity

- The time during seed development when the seeds can be harvested without significant reduction in seed quality for germination

Collecting Seed from Research Field Plots

3 Types of Fruit Ripening

Type 1

- Dry fruits that do not dehisce at maturity

Type 2

- Dry fruits that dehisce at maturity

Type 3

- Plants with fleshy fruits

Harvesting and Handling Procedures for Dry Fruits that do not Dehisce at Maturity

- Seed and dry fruit adhere to each other at maturity
- Includes most agricultural crops, such as corn, wheat, and other grains
- Selected for ease of harvest and handling; mechanically harvested

Harvesting and Handling Procedures for Dry Fruit that Dehisce at Maturity

Drying

Fruits or capsules are placed on a screen to dry for 1-3 weeks

Extraction

Seeds are separated from fruit

Cleaning

Removal of debris and weed seed

Commercial-Scale Seed Separation




Laboratory-Scale Seed Cleaning Devices


Harvesting and Handling Procedures for Fleshy Fruit

Small seed lots

- Extraction

Larger seed lots

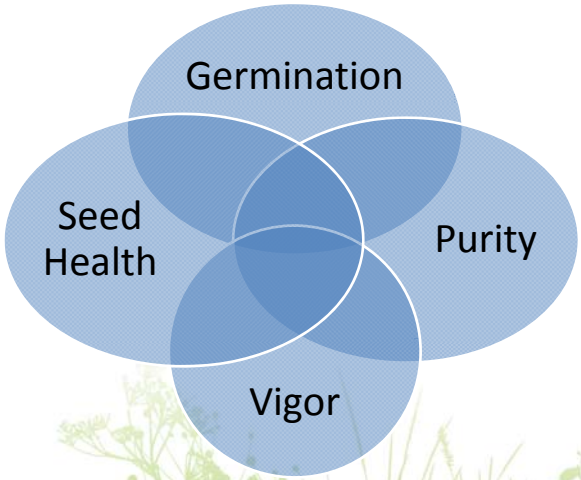
- Maceration
- Fermentation
- Chemical Treatment
- Flotation

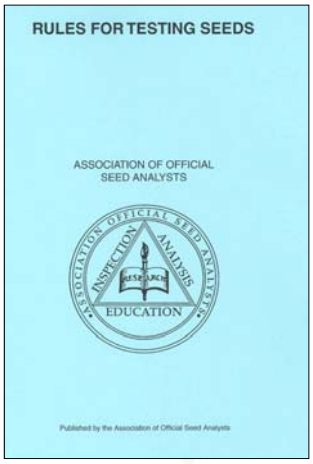
D. Bates- Native Nursery
Process used to clean Coontie seeds





High Quality Seed





Elite Seed

Seed Testing Associations

USDA Federal Seed Act

- procedures for testing agricultural and vegetable seeds

(AOSA) Association of Official Seed Analysts

- procedures for testing seeds of flower, tree, and shrub species

(ISTA) International Seed Testing Association

- rules for testing seeds for tree, shrub, agricultural, and vegetable species

Seed Sampling for Testing

A sample from each seed lot must be tested prior to sale

A portion of the seed lot will be tested for purity

An additional sub-sample will be evaluated for standard germination

Laboratory Methods for Testing Germination

Species	Sub-strate	Temp (°C)	First Count	Final Count	Comments
Barley	B, T, S	20, 15	4	7	Prechill 5 d
Yarrow	TB	20-30	7	14	Light
Prunus	P	18-22	NA	10-14	Embryo excision, TZ

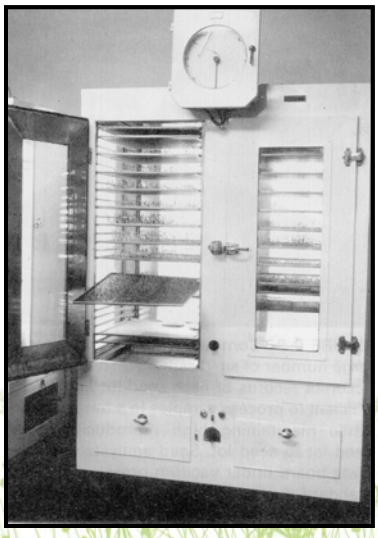
Viability Determination

1. Germination percentage
2. Excised-embryo test
3. Tetrazolium test
4. X-ray analysis

1. Standard Germination

- Represents the percentage of seedlings in a seed lot that germinate normally

Commercial Germination Chambers



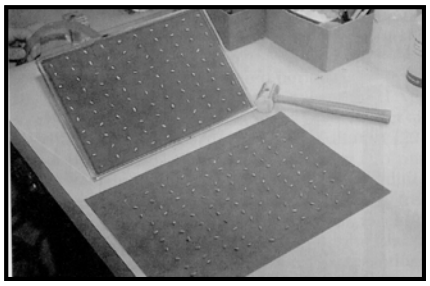
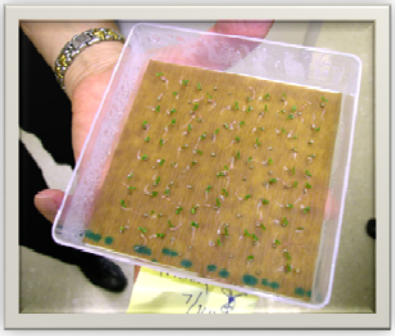


Figure 6-9: Hartmann et al., 2002

Germination Tests



Vacuum Seed Planting

Germination Rooms

2. Excised Embryo Test

- Used to test viability of woody shrubs and trees whose dormant embryos require long treatment periods to relieve dormancy before true germination will occur

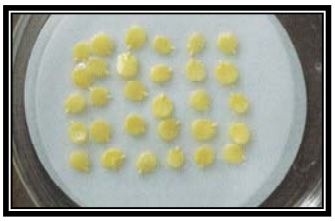


Fig. 6-22: Hartmann et al., 2011

3. Tetrazolium Test

- A biochemical method of viability determined by the red color appearance when seeds are soaked in TCC.

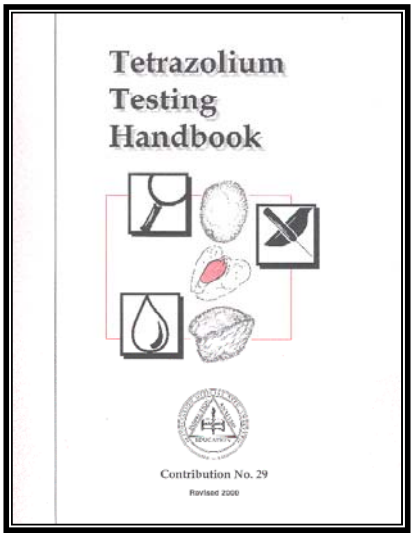
Fig. 6-23:
Hartmann et al., 2011

In scrophulariaceae, the endosperm must stain in addition to the embryo

Pos. Neg. Neg.

Tetrazolium Testing Handbook, 2000

Tetrazolium Testing Handbook-AOSA



4. X-Ray Analysis

- Used to examine the inner seed structure for mechanical disturbance, absence of embryo or endosperm, insect infestation, damage of seed coat, or tissue shrinkage

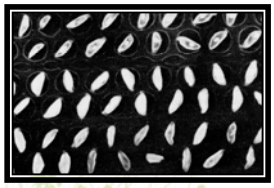


Fig. 6-14: Hartmann et al., 2002

Seed Purity

- The percentage by weight of the "pure" seed present in a sample

Physical	Genetic
• separation from physical contaminants	• cultivar identification

Seed Vigor

– An estimate of the seed's ability to germinate when the environmental conditions are not ideal for germination.

- Accelerated aging
- Cold/cool test
- Electrolyte leakage
- Seedling growth rate

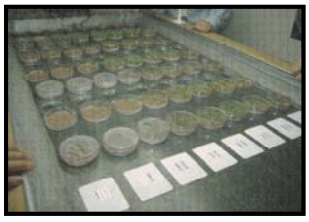


Fig 6-28: Hartmann et al., 2011

Ball Vigor Index

Seed Health

-Occurrence of disease, insects, or nematodes in the seed lot

- Visual evaluation
- Incubation of seed
- Biochemical

Seed Protectants

- Designed to protect seed from soil-borne pathogens
- Disinfest the seed from pathogens on the seed surface
- Eliminate pathogens inside the seed

Seed Coating

- Objective is to enhance the germination potential or facilitate mechanical sowing of seed

Seed Coating

Coating Larger Lots of Seed

Germination Enhancement

Seed sizing

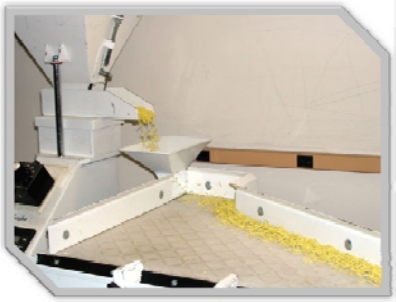
Seed priming

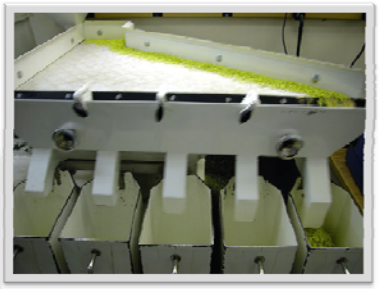
- -osmotic
- -solid matrix
- -drum

Pregermination

- fluid drilling

Seed Sizing





Seed Priming

- A controlled hydration seed treatment that induces faster, uniform germination.

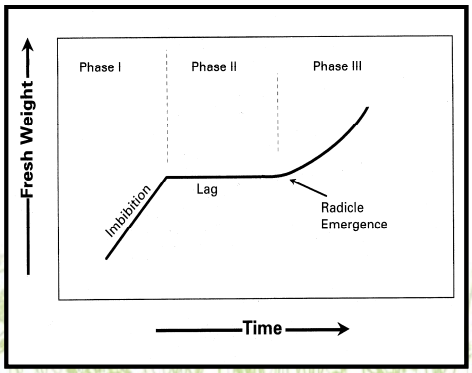


Fig. 7-3: Hartmann et al., 2011

Primed vs. Unprimed Seed

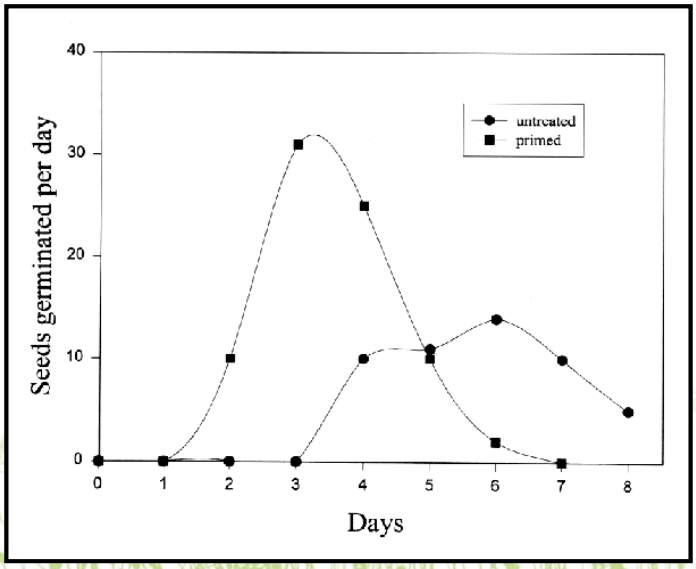


Fig. 7-20: Hartmann et al., 2011

Seed Storage

Short-lived seed	Medium-lived seed	Long-lived seed
• 0-1 yr. • Recalcitrant • temperate-zone trees, tropical plants, aquatic plants of temperate zones, trees with large fleshy cotyledons.	• 2-15 yr. • Orthodox • conifers, fruit trees, vegetables, flowers	• 15-100 yr. • Orthodox • hard seed coats impermeable to water; legume, geranium, morning glory family

Phases of water uptake during germination

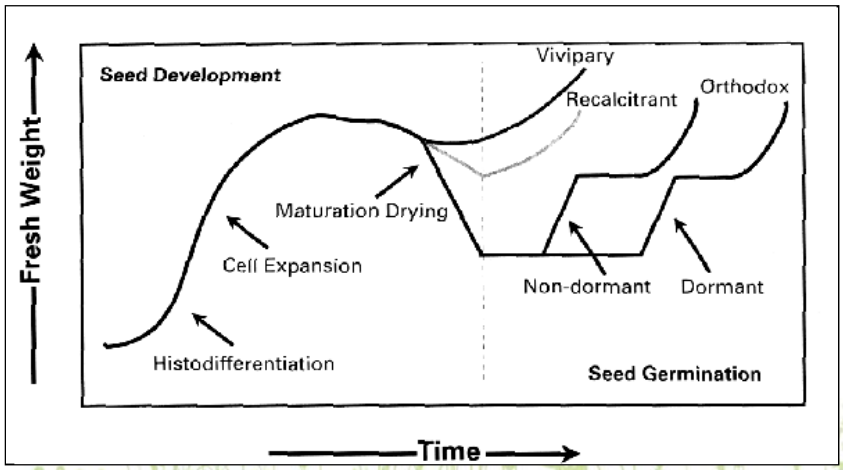


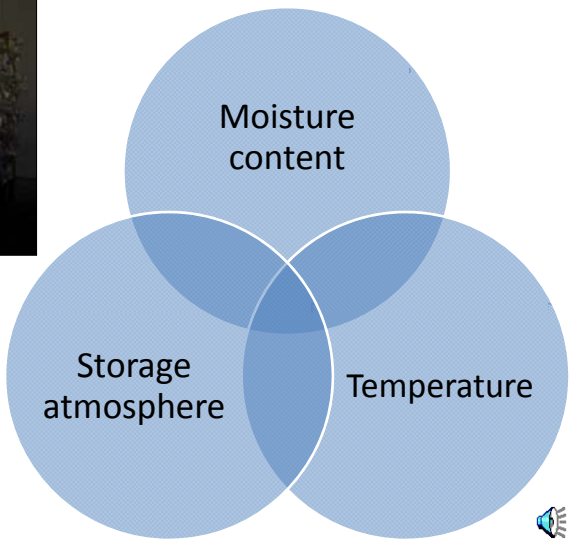
Fig. 7-2: Hartmann et al., 2011

Relative Storability Index

Crop	Cat. I (1-2 yr)	Cat. 2 (3-5 yr)	Cat. 3 (>5 yr)
Agronomic	Soybean Peanut	Barley Wheat	Alfalfa Clover
Vegetable	Bean Lettuce	Broccoli Spinach	Beet Tomato
Flower	Begonia Pansy	Marigold Petunia	S. Daisy Zinnia

Table 6-2: Hartmann et al., 2011

Storage Factors Affecting Seed Germination



Seed Storage and Packaging

Variety Trials-Ball Seed

Greenhouse Trials-Ball Seed




Pack Trials-Holland


PanAmerican Seed 2004 European Spring Pack Trials (Rijsenhout, Holland)

Hem Genetics Spring Pack Trial (Hem Holland)

Web-based Lecture-
Plug Production

Dr. Kim Moore

Professor, University of Florida, Fort Lauderdale

Knox Nursery-

Virtual field trip

Winter Garden, FL