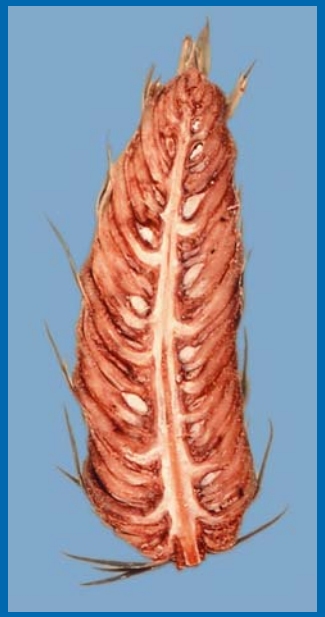
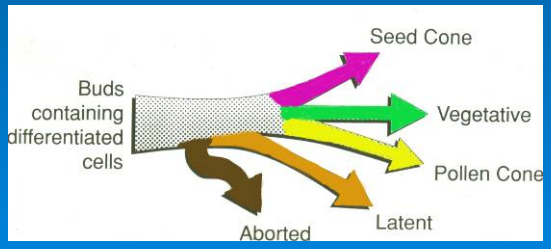
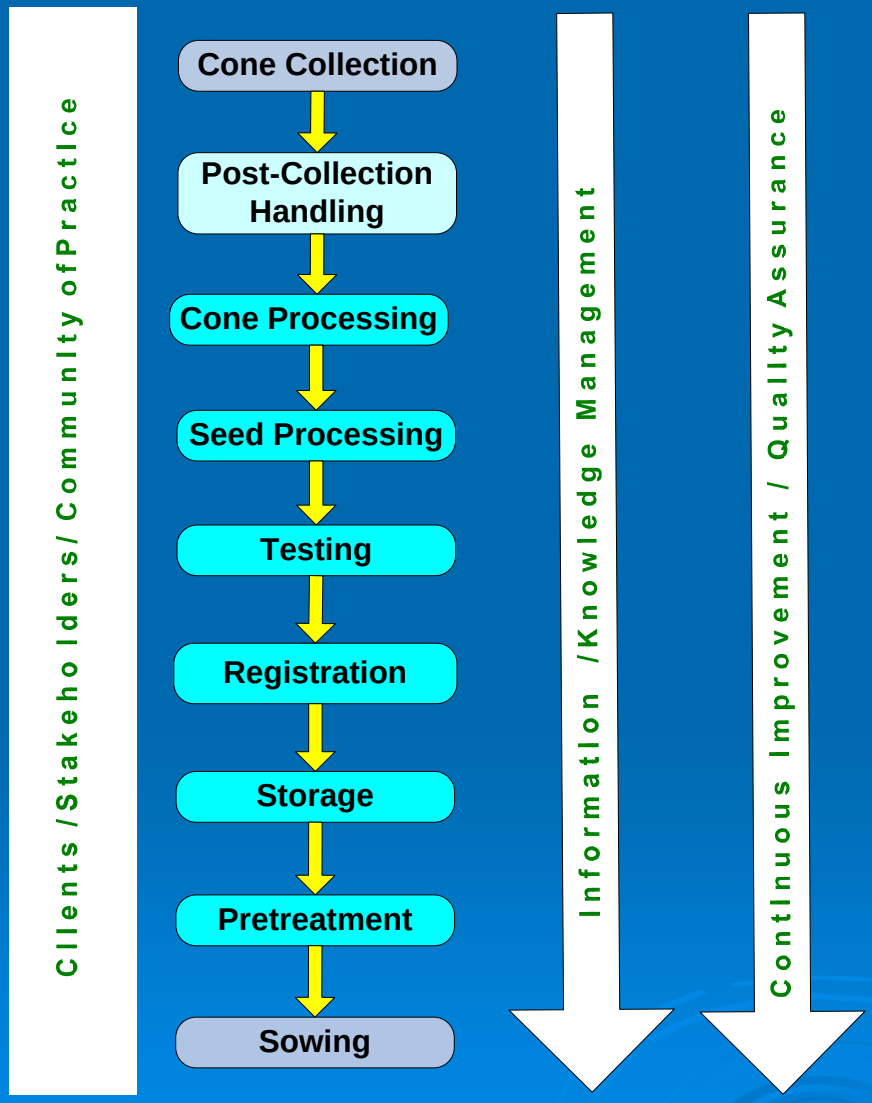
Seedlot Production





Dave Kolotelo

Seedlot Production



- ★ Cone + seed evaluations
- ★ Cone + seed processing
- ★ **Seed Storage***
- ★ **Seed Testing***
- ★ **Registration***
- ★ Pretreatment & **distribution***

Quality Assurance (QA)

- *"the evaluation, monitoring and management of information and practices related to activities in the Seed Handling System"*

QA Foundations

- Avoid Physical contamination (debris)
- Avoid seedlot contamination (adaptation)
- Information Management (Organization)
- Handling a perishable product (Care)

germination, moisture content, fungal assays, cutting tests, observations, pellet assessment

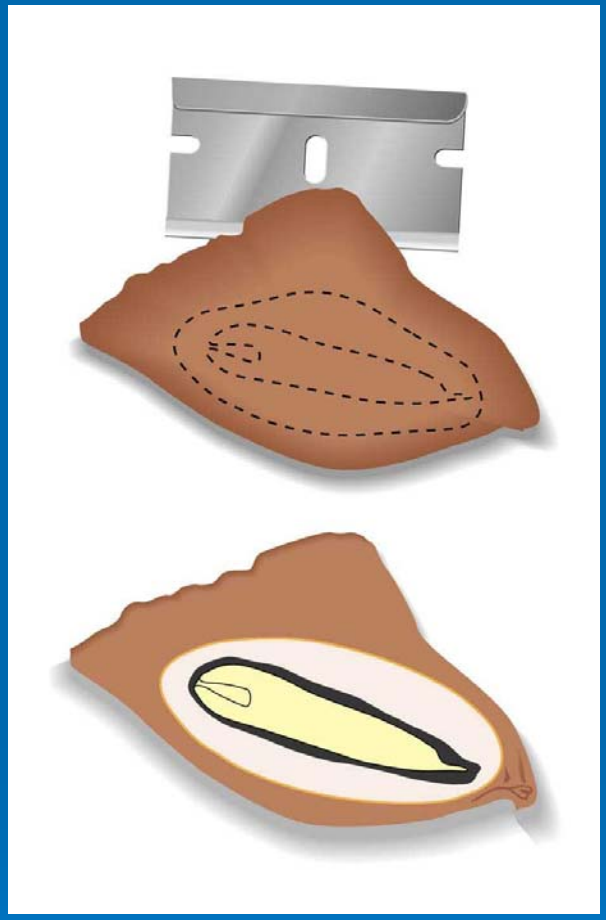
Pre-collection Evaluations

- Monitoring of the condition of cones and seeds prior to harvest is important
  - determine crop size (plan for resources)
  - determine (possibly act on) Pest problems
  - determine maturity level
- Seed quality (GC and storability) is maximal at time of natural dispersal
- Dehydration of cones and seeds accompanies maturation
- Moisture content is related to damage potential (m.c. ⇧ then risk ⇧)

Cone Receipt & Storage

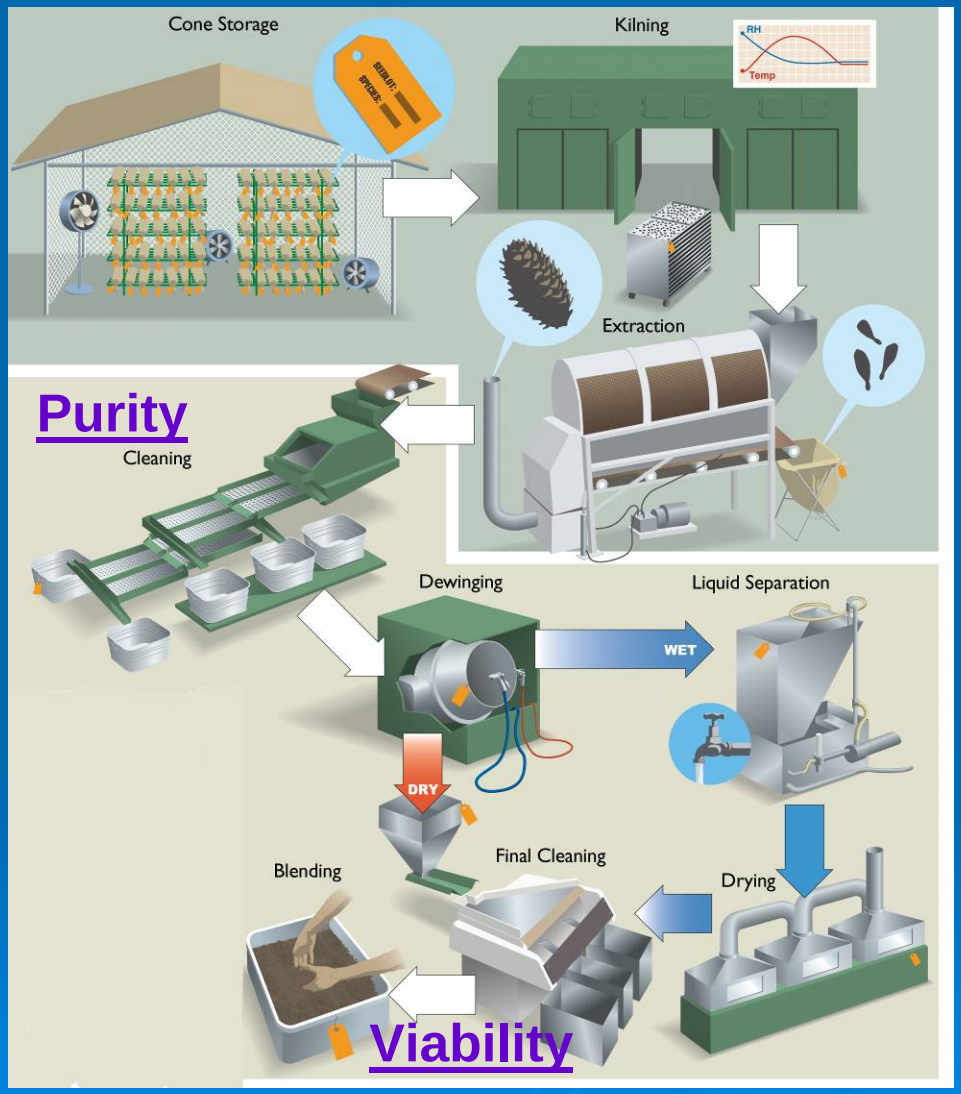
- Unload, rack (except Pli) and store cones
- Randomly sample and evaluate cones and seed
  - potential yield
  - pest or other problems
  - aid processing prioritization
- Goal is to slowly dry the cones (after-ripening)
- turn sacks (uniformity)
- Protect from sun, rain, animals
- Allow for good air-flow (1 sack depth*)

Cutting Tests



- Seed anatomy tests
- Vital to assessing seed maturity
- embryo length in relation to corrosion cavity **(> 90%)**
- megagametophyte ‘texture’ **(coconut analogy)**
- categorize to needs
  - Viable
  - damaged and discoloured

Cone and Seed Processing



Cone Processing

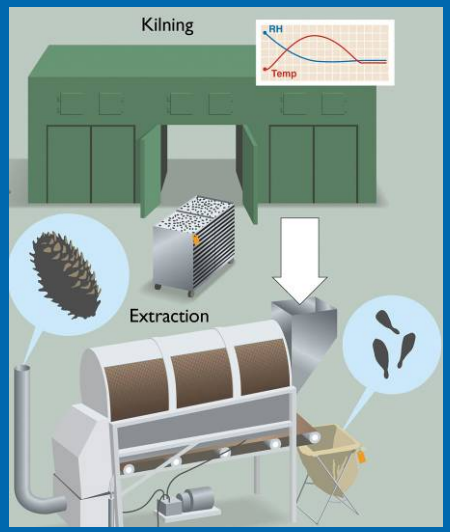
Remove Released Seed

↓

Kilning (cone opening)

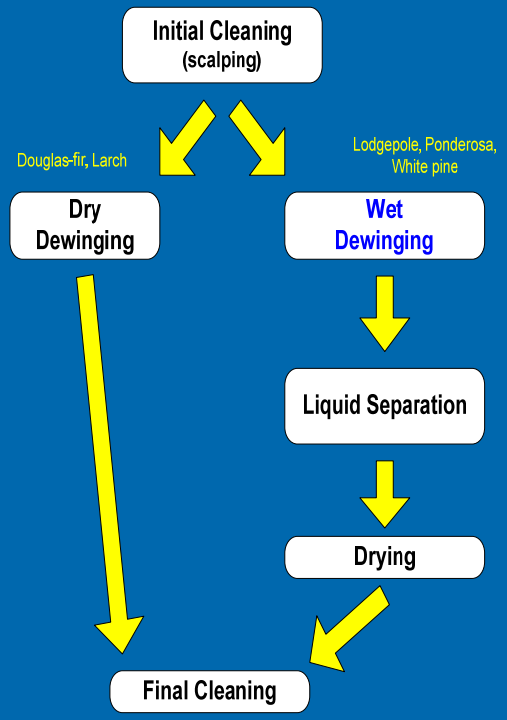
↓

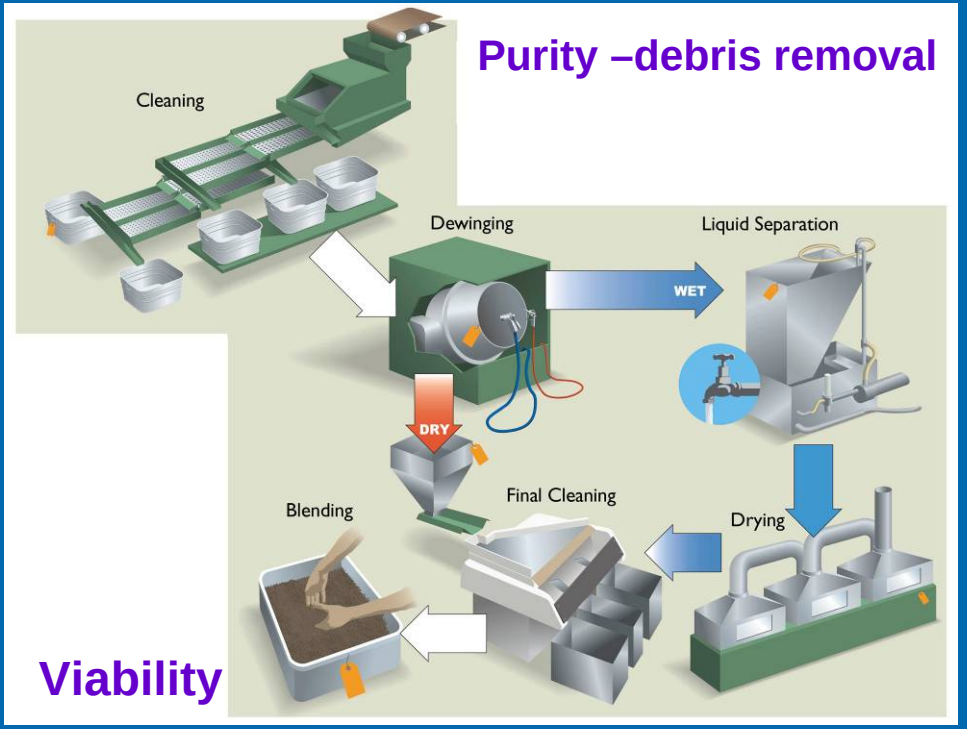
Tumbling (seed removal)



- An initial screening separates released seed + debris from cones (avoid kilning free seed)
- Kilning overnight
- Peak temperature
  - Pli 60° C
  - Most 40° C
  - **Cw, Hw, Abies spp. not kilned**
- Tumble to remove seed (monitoring)

Seed Processing

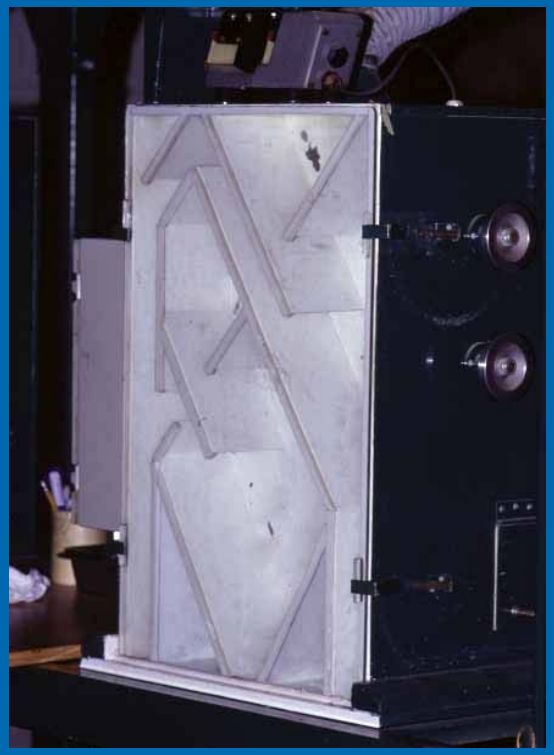




- Remove abrasive, moisture and fungi containing material ASAP **(Purity)**
- Anatomy differences determine method of dewinging (next slide)
- Possibly secondary cleaning
- Ensure viable seed not lost with debris
- Final cleaning to remove empty or dead seeds **(Viability)**

Wet *vs.* Dry

Final Cleaning and Blending



Blending of TSC and other processors products before sampling and storage

Process to Chief Foresters Standards

- clean to a minimum of 97% purity
- dry to a moisture content between 4-9.9%

Cone and Seed Processing

What does a seed need to germinate?

- **Moisture**
- **Overcome Dormancy** **(None in Cw)**
- **Temperature Sums**

properly stratified conifer seed does not have a light requirement

some broadleaf trees/shrubs have more specific requirements - light, alternating temperature and/or moisture, gases, nutrients, smoke

Conifers are relatively simple to germinate

(except Yc, Pw, Ba, Bn, Bl) >2% sowing

Efficiency is the issue – large energy input !

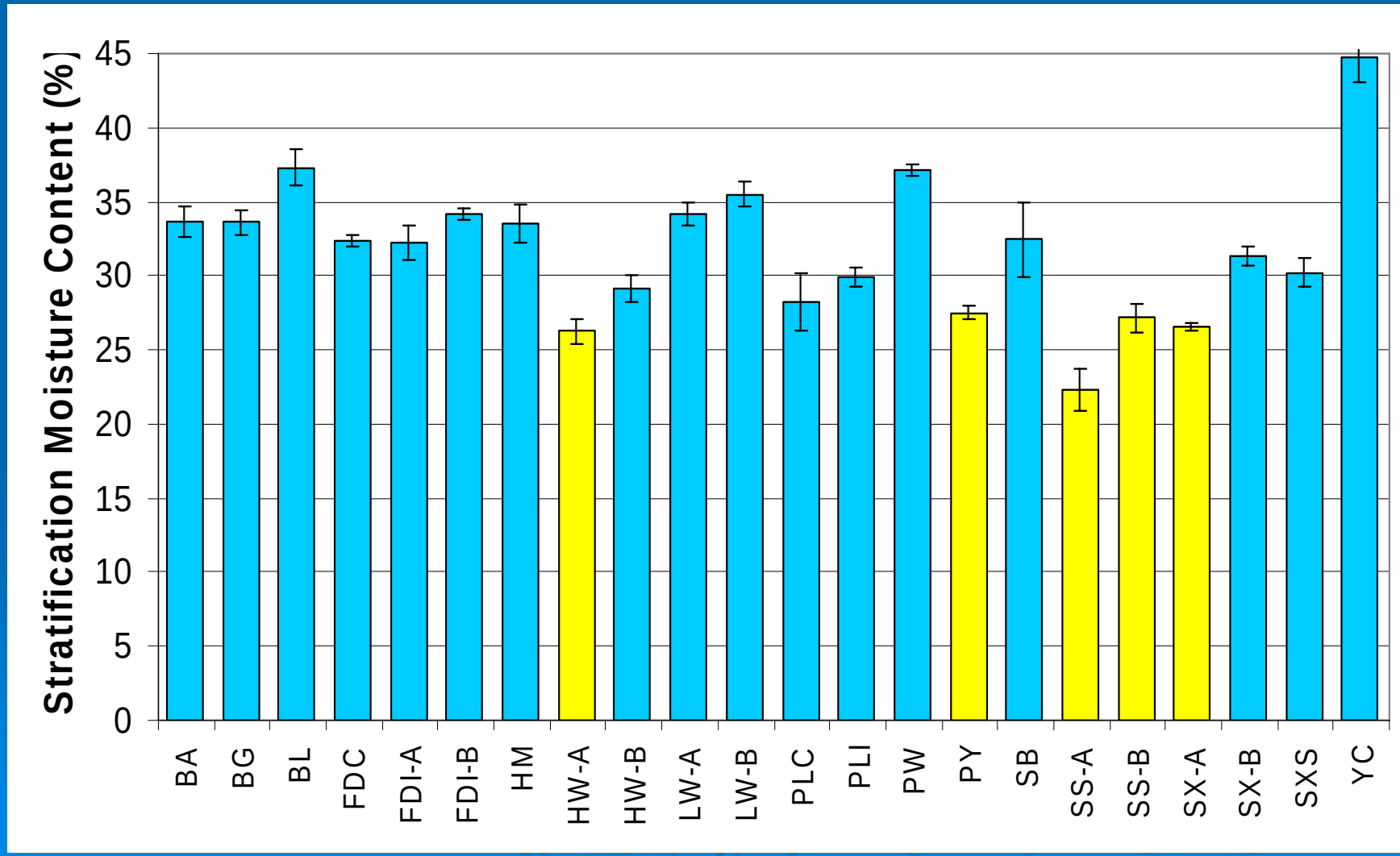
Moisture same methods testing and inventory management

- Storage (-18 C) at 4.0-9.9% (minimize metabolism)
- Seed needs a minimum of about 20% to overcome dormancy
- Soak durations equal in testing and sowing request prepapartion

Species	Soak (hours)
Cw	none
Sx, Pl, Fd, Lw, Hw ++	**24**
Ba, Bg, Bl, BN	**48**
Yc	**72**
Pw	336 (2 wks)

Stratification Moisture Content

5-year average (2003-2007)



“Dormancy may be perceived as a strategy for optimizing the distribution of germination through space and time in order to maximize survival, but this seldom coincides with the nursery workers objectives”

Seed Dormancy

- failure of an intact viable seed to complete germination under favourable conditions

- Physiological or 'embryo' dormancy

  No Dormancy - **Cw**
  Low Dormancy- Hw, Sx, SS, Lw, Fd
  Mid Dormancy - Pli, Hm, Bg, Py
  Deep Dormancy-**Yc, Pw, Ba, Bl, BN**

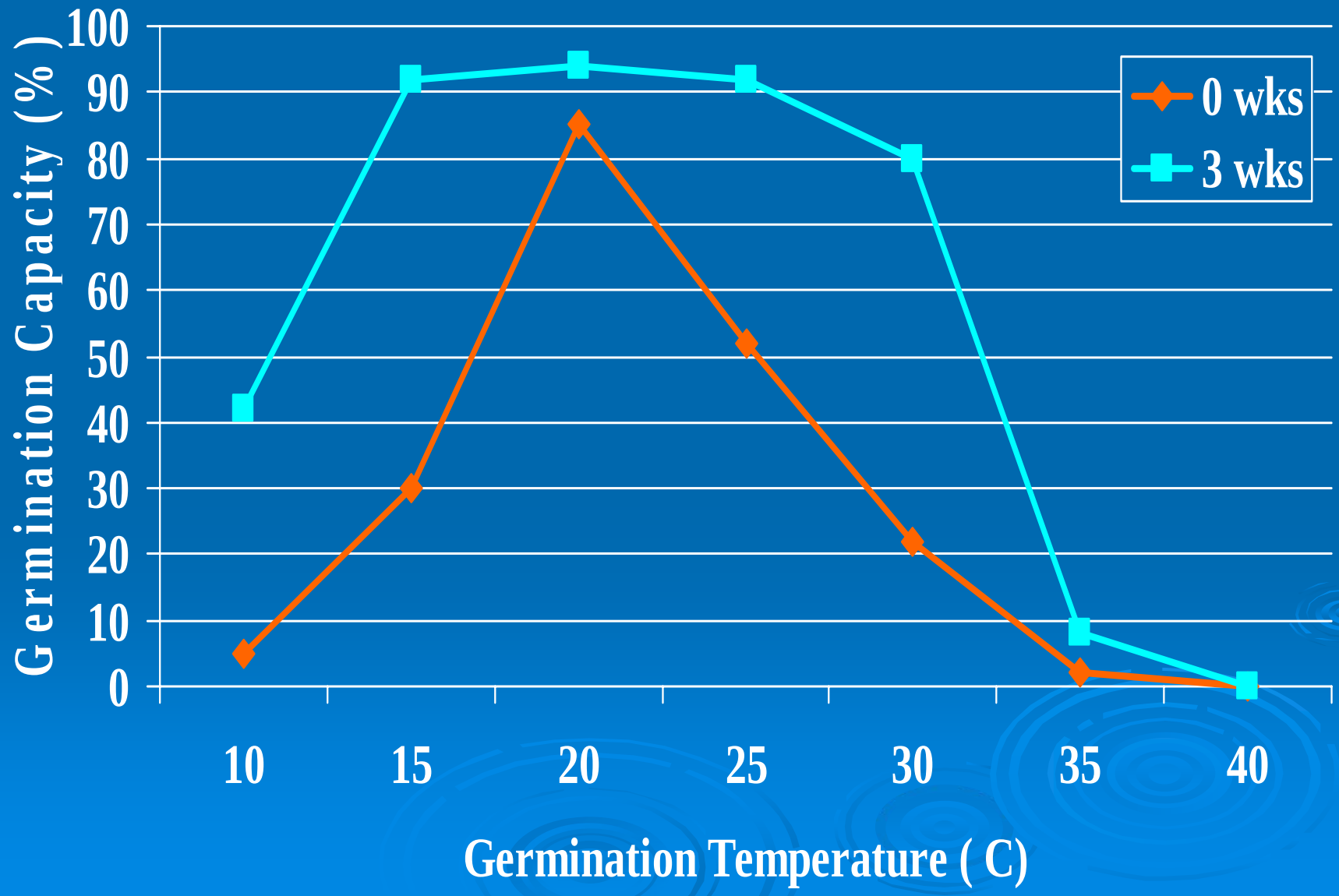
Physical seed coat or 'membrane' dormancy is associated with Pw and Yc

Lots of Variability within a species

Stratification Durations

Species	Stratify (Days)
Cw	0
Sx, SS, Fd, Lw,	21
Pli, Py, Bg	28
Ba, Bl, Bn, Yc	92 - split
Pw	112+

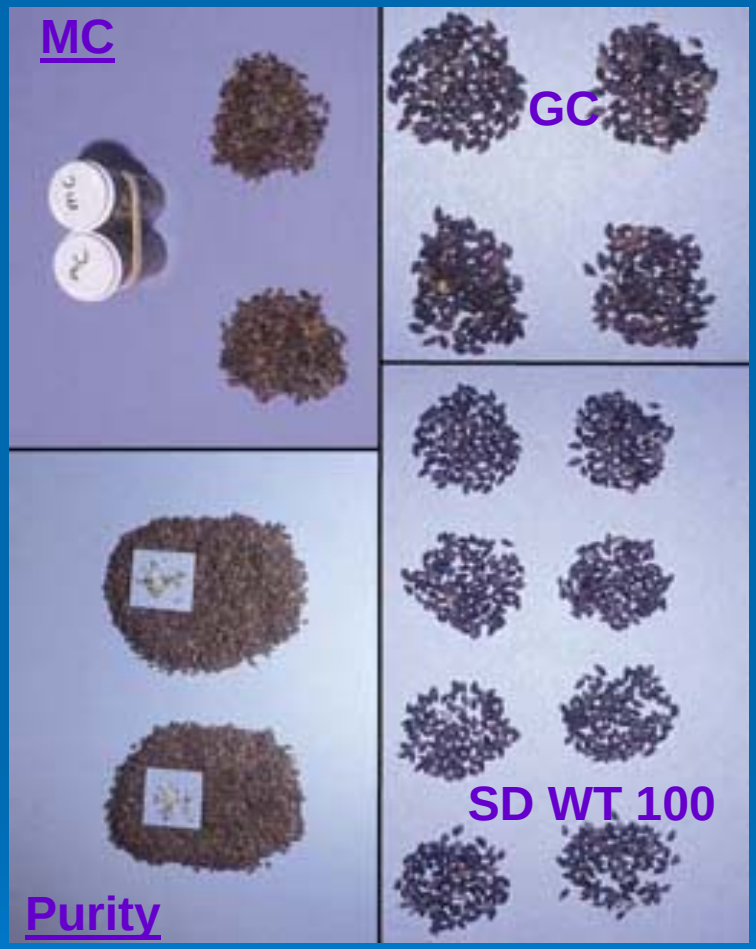
Stratification increases Vigour



Temperature

- If adequate moisture is available and dormancy is overcome then temperature is the rate limiting factor
- biological limits exist (30-35° C) that depends on moisture content and species
- increased germination temperatures result in faster, more uniform germination that also reduces the window of opportunity for pests
- soil or grit temperature more useful

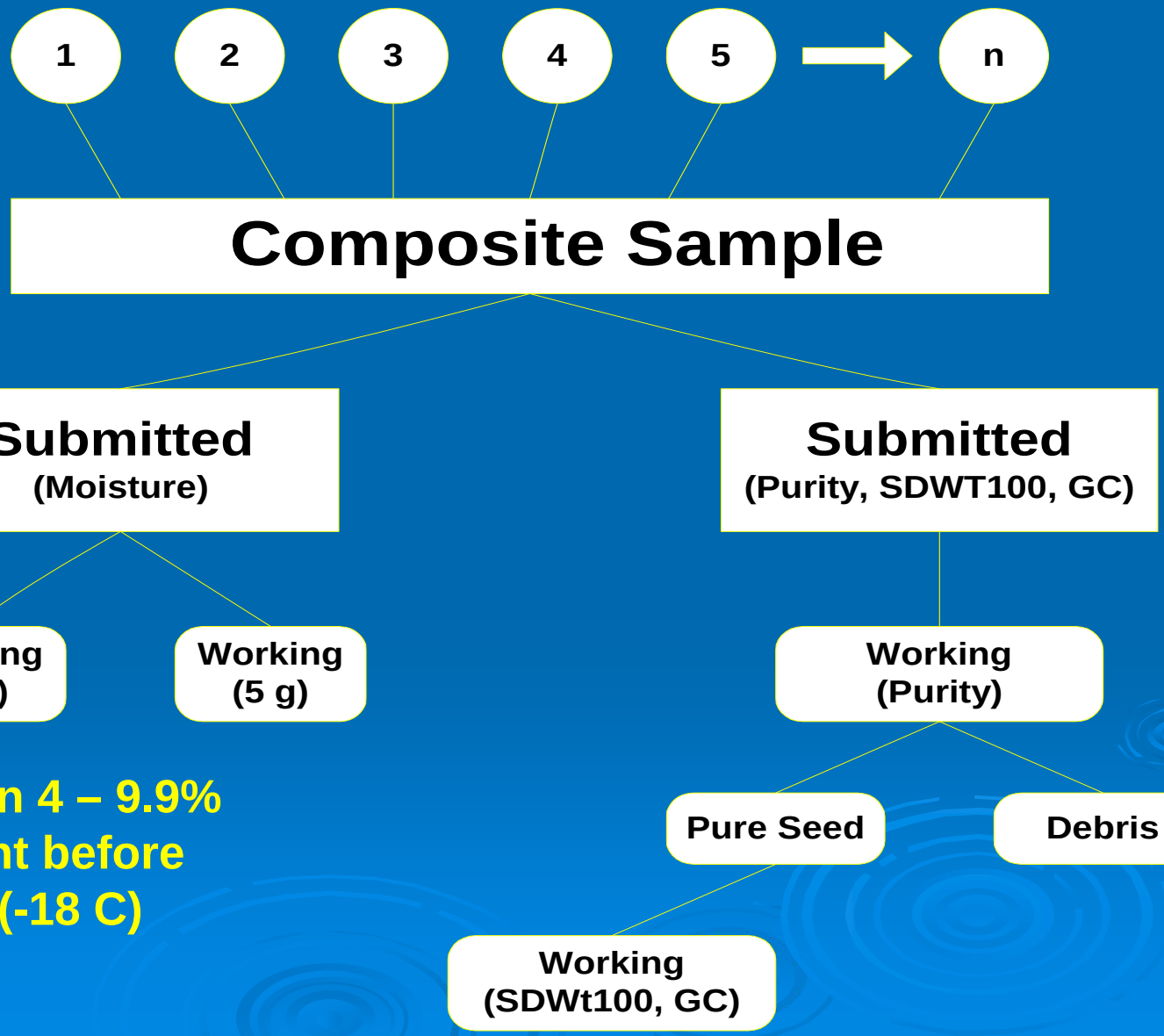
Testing



- **Conduct Standard tests (Seedlots)**
  - **Purity**
  - **Moisture content**
  - Average seed weight 100 seeds
  - Germination (possibly several tests)
  - Total seedlot weight
  - X-ray, possibly fungal assays
- Identify/schedule seed for **retesting GC**
- (18 months –Cw, Yc to 48 months SS)
- ISTA/ AOSA are primary guides
- **Conduct QA tests (samples– ie SRQ)**
  - SRQ GC + mc, unkilned seed
  - Returned seed, pellet assessment
  - Cutting tests, **observations**

Random
Representative

ISTA/AOSA
Guidelines

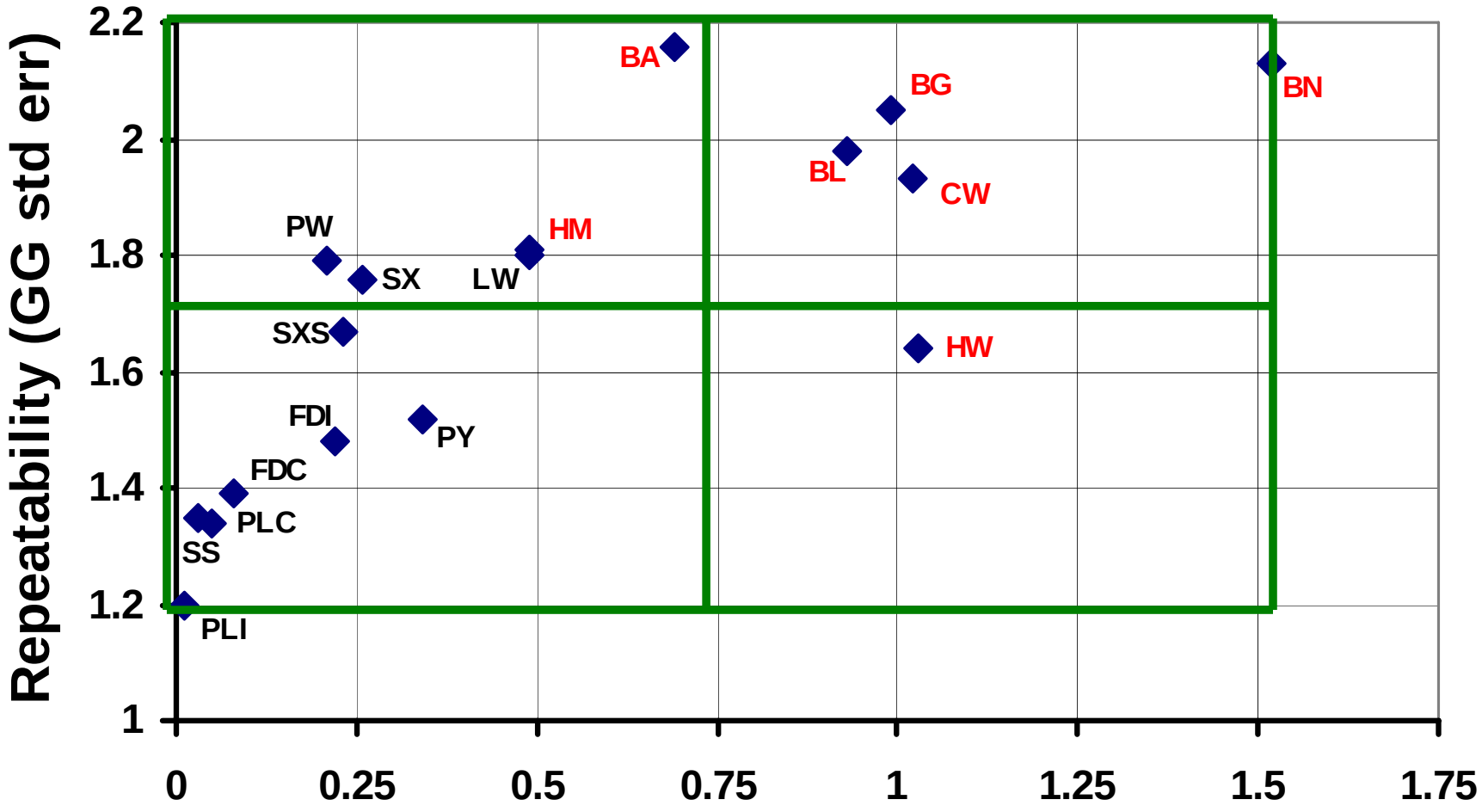


1. Seed between 4 – 9.9% moisture content before freezer storage (-18 C)

Seeds per Gram

- Calculated variable accounting for seed weight and seedlot purity
- Seeds per Gram = $\frac{\text{Purity (\%)}}{\text{Seed Wt 100}}$.
- i.e.) **SPG = 98% / 0.21 100-seed weight = 467** seeds per gram
- SPG is influenced by seed size, moisture content and purity
- part of **Sowing Guideline** calculations
- Orchard produced seed on average 15% larger
- **(Pli - 34%; Sx - 18% / Cw + Yc - little difference)**

Species Germination Characteristics



GC =85%, 95% CL

se=1.2 → **81 to 89%**

se=2.2 → **78 to 92%**

Resin Vesicles

Present in Hw, Hm, Cw and all *Abies* spp.

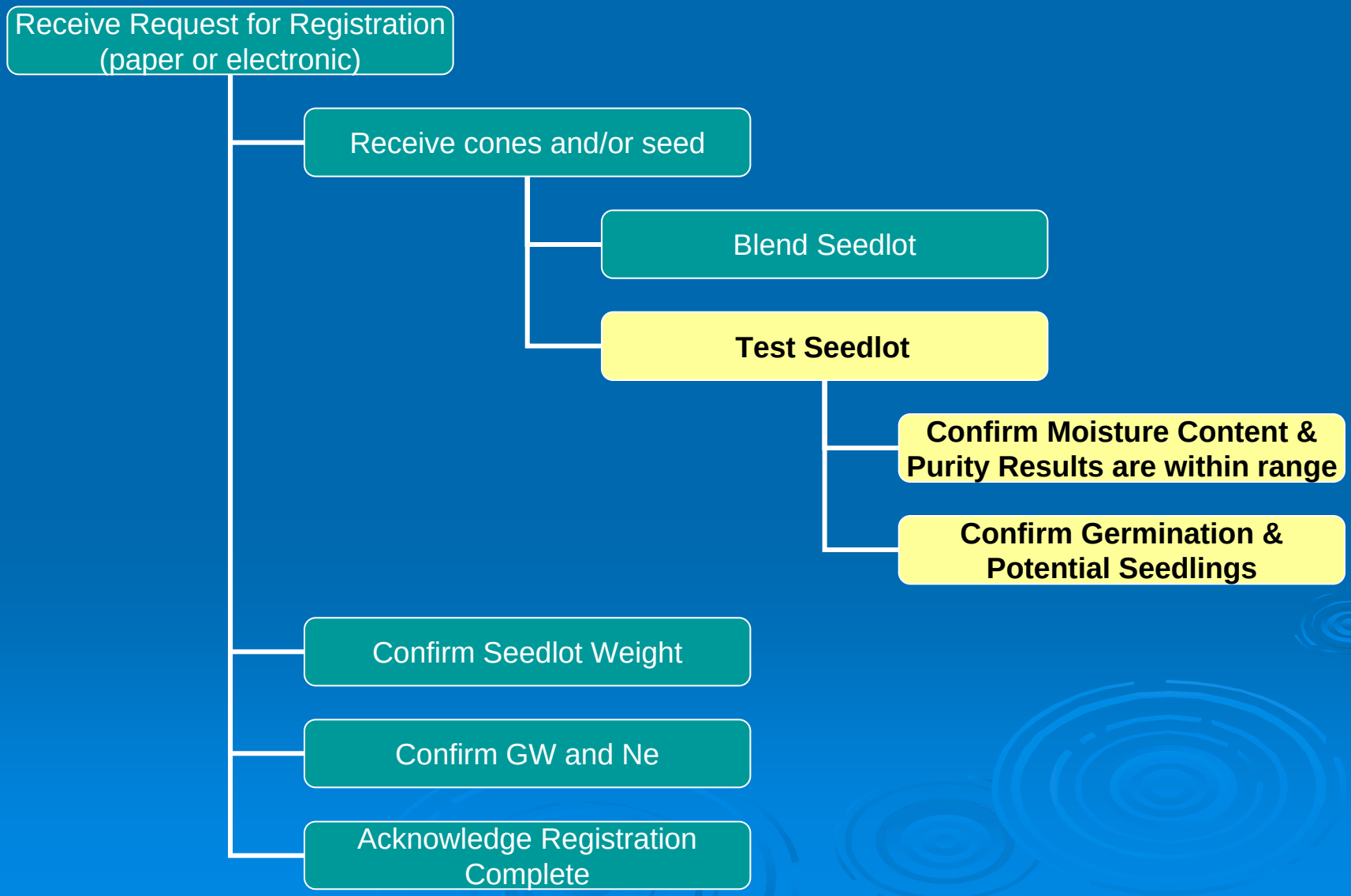
Function not known ??

- protection against excessiove drying
- may inhibit germination (dormancy)

Damaged Ba resin vesicles

Damage to resin vesicles will reduce germination

Seedlot Registration



Seed Storage

- Moisture < 9.9%
- minimal metabolic activity (-18°C)
- seedlot deterioration estimated as
  - ΔGC / Δtime
- retest species deteriorating faster more often

- **Gene Conservation**

Seed Preparation & Shipping

Activities

- Scheduling
- Manage changes
- Withdraw seed
- Prepare seed
  - soak and stratify
  - pellet
  - send dry
- Monitor **(esp. Yc, Ba, Bl, Pw)**
- Label and ship seed

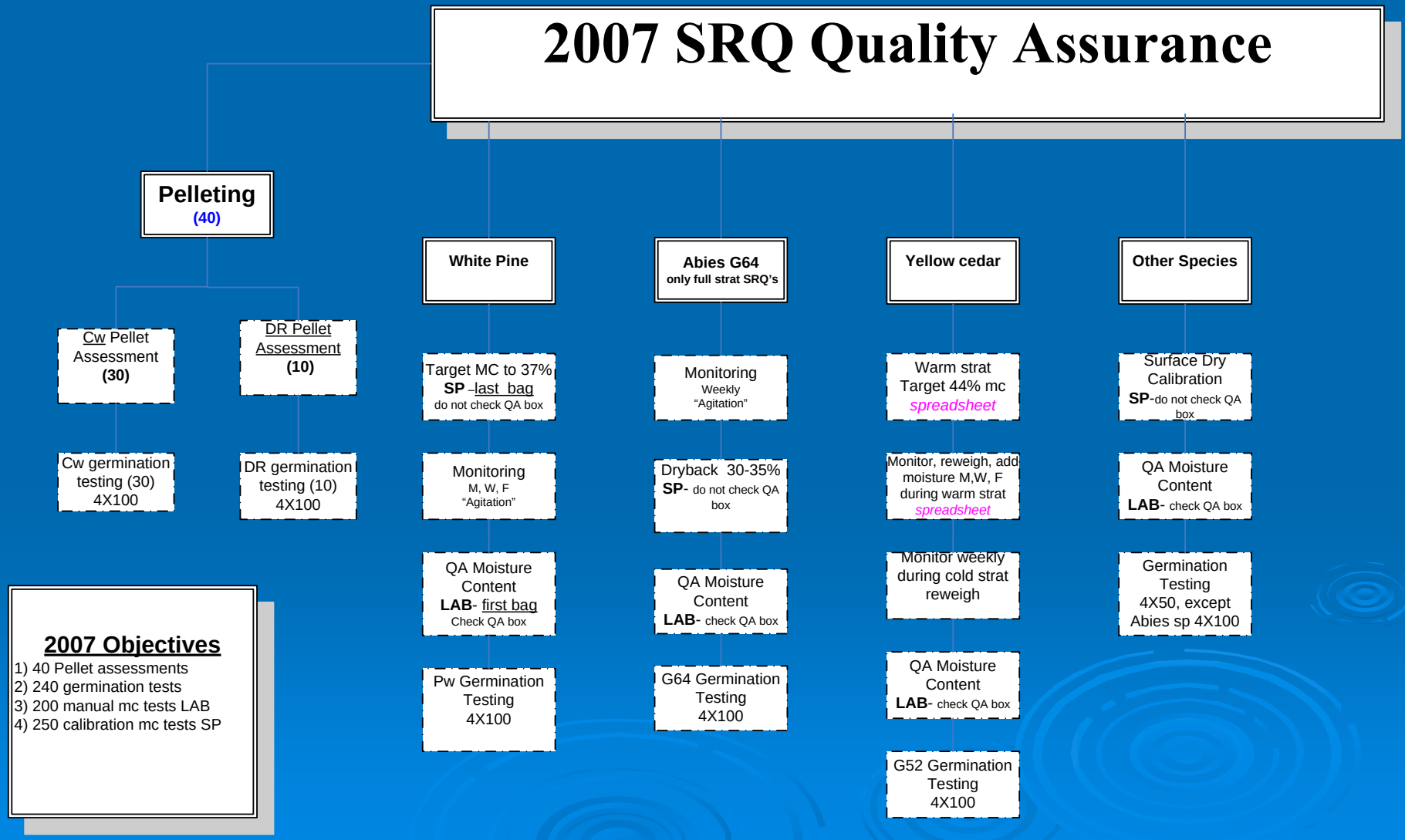
Seed Soaking

Stratification, Monitoring & Shipping

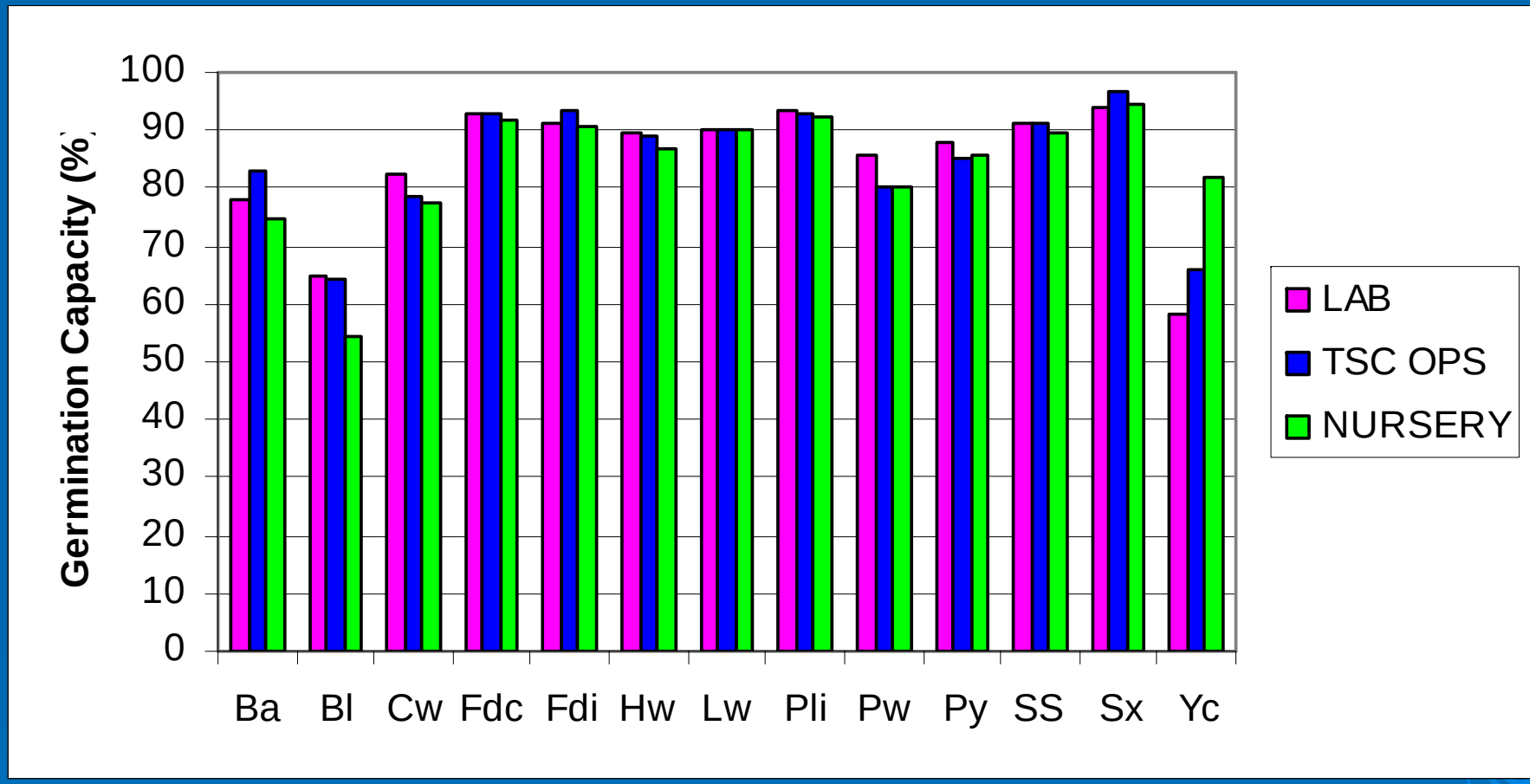
- Seed is surface-dried prior to chilling

- Stratification in plastic bags
  - Top of bag open
  - 2 to 4 mil bags allow for oxygen exchange
- Monitoring
  - fungi /pre-germination
  - Equilibrating moisture (close opening – shake)
- Communication with nurseries
- Arrange efficient shipping to nursery

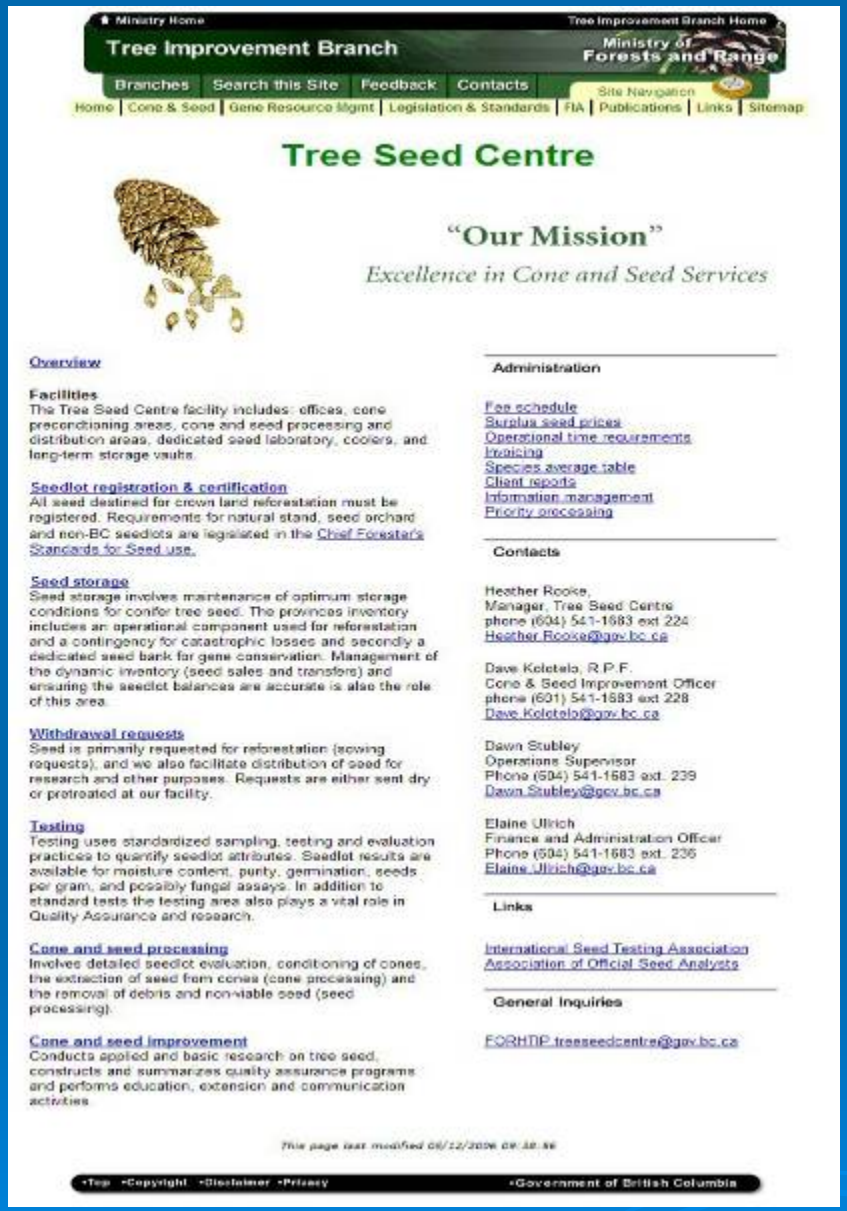
Sowing request QA schematic



Quality Assurance Germination Results



- Thank you to nurseries for supplying GC information
- Bl, Pw exhibited largest falldowns
- Yc testing improvements required



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Tree Improvement Branch — Ministry of Forests and Range

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Tree Seed Centre

"Our Mission"

Excellence in Cone and Seed Services

Overview

Facilities
The Tree Seed Centre facility includes: offices, cone preconditioning areas, cone and seed processing and distribution areas, dedicated seed laboratory, coolers, and long-term storage vaults.

Seedlot registration & certification
All seed destined for crown land reforestation must be registered. Requirements for natural stand, seed orchard and non-BC seedlots are legislated in the Chief Forester's Standards for Seed use.

Seed storage
Seed storage involves maintenance of optimum storage conditions for conifer tree seed. The provinces inventory includes an operational component used for reforestation and a contingency for catastrophic losses and secondly a dedicated seed bank for gene conservation. Management of the dynamic inventory (seed sales and transfers) and ensuring the seedlot balances are accurate is also the role of this area.

Withdrawal requests
Seed is primarily requested for reforestation (sowing requests), and we also facilitate distribution of seed for research and other purposes. Requests are either sent dry or pretreated at our facility.

Testing
Testing uses standardized sampling, testing and evaluation practices to quantify seedlot attributes. Seedlot results are available for moisture content, purity, germination, seeds per gram, and possibly fungal assays. In addition to standard tests the testing area also plays a vital role in Quality Assurance and research.

Cone and seed processing
Involves detailed seedlot evaluation, conditioning of cones, the extraction of seed from cones (cone processing) and the removal of debris and non-viable seed (seed processing).

Cone and seed improvement
Conducts applied and basic research on tree seed, constructs and summarizes quality assurance programs and performs education, extension and communication activities.

Administration

Fee schedule
Surplus seed prices
Operational time requirements
Invoicing
Species average table
Client reports
Information management
Priority processing

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Links

International Seed Testing Association
Association of Official Seed Analysts

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