

Seed Matters 4

Seed imbibition times for sowing
Alberta pines and spruce



Alberta Agriculture and Forestry, Government of Alberta

Date of publication: April 2020

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ISBN 978-1-4601-4744-3

Alberta Tree Improvement & Seed Centre

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For more information, please contact the author:

Lindsay Robb, Provincial Seed Specialist at ATISC@gov.ab.ca

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Executive summary

The following are recommendations only, above and beyond the Alberta regulations (Alberta Forest Genetic Resource Management and Conservation Standards, [FGRMS]) and only apply to growing seeds from lodgepole pine, jack pine and white spruce. For a copy of the latest FGRMS regulations, please visit [Alberta.ca](https://www.alberta.ca).

- A minimum clean water 2-hour soak is recommended for full imbibition of lodgepole pine, jack pine and white spruce seeds before stratification or sowing (if not stratifying). Longer soak times will not result in further water uptake.
- The use of the usual 24-hour soak should not be discounted, as there have been no reported observations of negative effects using this method. There is a possibility that ageing, less vigorous seed lots may respond unfavourably to this longer treatment but this has not been tested here and would not apply to the vast majority of seed lots sown in Alberta, which are used before vigour begins to decline.
- Results from a trial run at the Alberta Tree Improvement & Seed Centre (ATISC) can assist nursery schedule managers in choosing whether to skip long soak times. Imminent holidays, high workloads or last-minute orders are all instances where nursery managers may decide that time or economy dictates a 2-hour soak. This allows more schedule flexibility for this industry while providing proof of no negative effects on germination rates, final seedling counts or quality.

Contents

Executive summary	3
Background	5
Method	5
Results	6
Conclusions	7
References	7

Background

Standard practice when preparing lodgepole pine (*Pinus contorta* Douglas ex Loudon), jack pine (*Pinus banksiana* Lamb.) and white spruce (*Picea glauca* (Moench) Voss) seeds for cold stratification or direct sowing in Alberta nurseries is to first soak the seeds in clean water for 24 hours or overnight. However, we also know from experience that these seeds imbibe water relatively quickly.

The Alberta Tree Improvement & Seed Centre (ATISC) conducted a trial with the purpose of determining approximately how long lodgepole pine, jack pine and white spruce seeds need to be in contact with a moist substrate for full imbibition to occur.

These results will assist nursery schedule managers in choosing whether or not to skip long soak times due to staffing, imminent holidays, high workloads, last-minute orders, etc. without the worry of sacrificing germination speed, seedling quantity or quality when producing reforestation seedlings for Alberta public land.

Method

Three wild registered bulk seed lots of lodgepole pine, jack pine and white spruce were randomly chosen. Three samples were taken from each seed lot. A baseline moisture starting point of each seed lot was recorded. All measurements were taken at approximately 22°C.

The three samples were spread in a single layer on moist cellulose wadding (Kimpak) in small plastic Hoffman boxes using 0.152 ml deionized water per square centimetre of dry media (Alberta Seed Testing Standards [ASTS]). At 30, 60 or 120 minutes, the samples were quickly scraped off the Kimpak and allowed to surface dry for approximately three to four minutes at 15% relative humidity.

Seed moisture was then measured using a recently calibrated Rotronic water activity meter. Each sample size was half the container volume (8 ml samples) to ensure accurate moisture measurements. Two consecutive water activity readings were taken using two different sensors. The two readings were then averaged for results, using accepted tolerance rules (ASTS).

Full imbibition was considered to be achieved at $99 \pm 3\%$ eRH (equilibrium relative humidity) to take into account the single replication and measurement error.

After moisture testing, each sample was also cut tested for visual confirmation of the hydration of all internal tissues.

Results

The seed moisture results for each species are recorded in Figure 1 below. All seed lots began with a moisture of approximately 60-70% eRH (~9-11% MC).

For all three species, imbibition of $99 \pm 3\%$ eRH was achieved and considered complete within the two-hour testing period. The two pine species achieved full imbibition within 30-90 minutes whereas all three white spruce seed lots were fully imbibed only at 120 minutes.

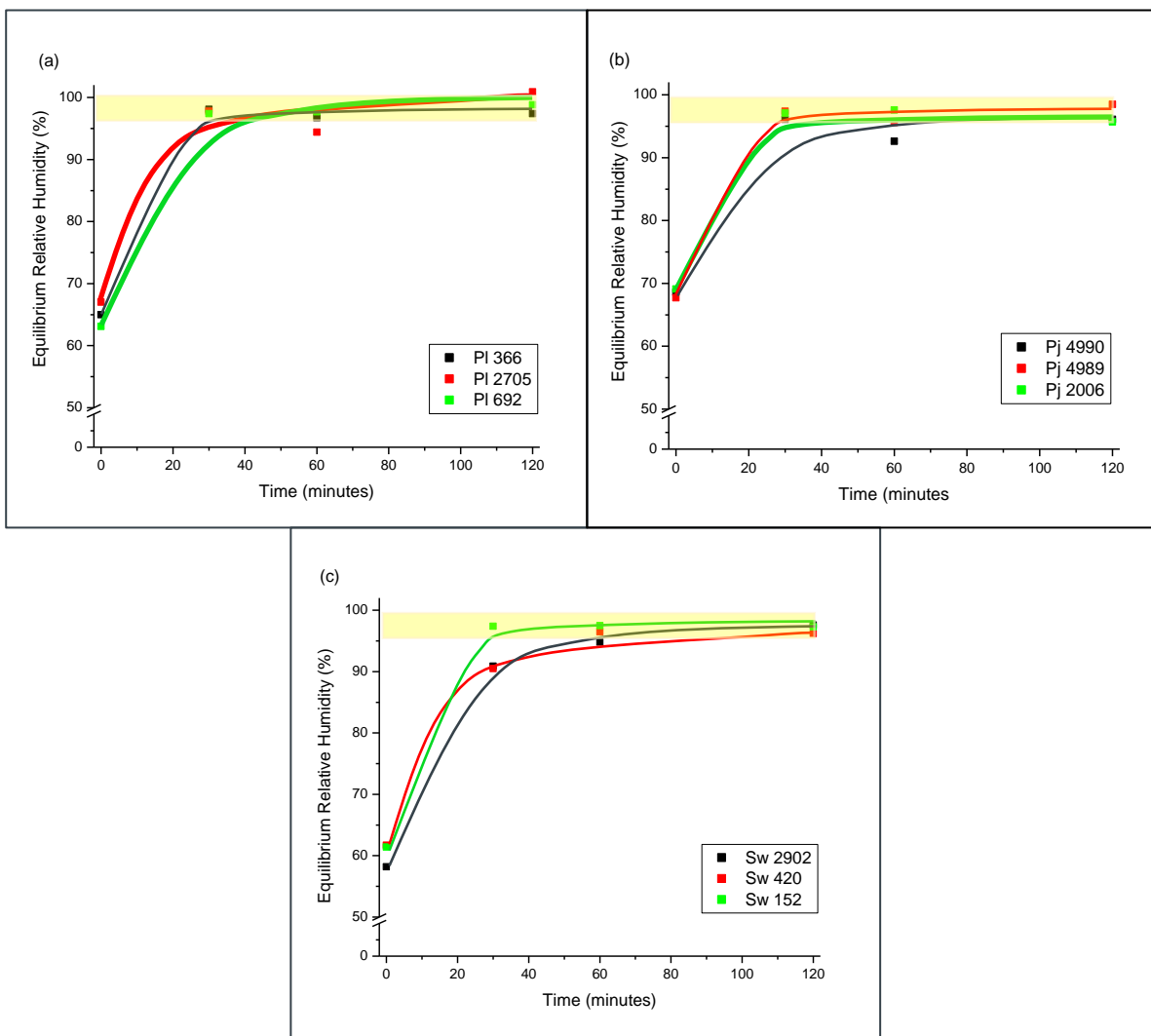


Figure 1: Imbibition of seeds over time, (a) lodgepole pine, (b) jack pine, and (c) white spruce. The yellow band indicates full imbibition ($99 \pm 3\%$ eRH).

Conclusions

The results in Figure 1 show that the 24-hour pre-soak that has been part of the pine and spruce stratification and sowing regimes in Alberta for quite some time, is completely effective at hydrating the seeds to begin stratification or germination.

However, based on the results, the practice could also be considered overly cautious. While there are some Alberta tree species that require extra-long soak times, for example the *Endangered* five-needle pines, the seed coats of lodgepole pine, jack pine and white spruce are clearly very permeable to water, allowing relatively fast drying as well as rapid water uptake.

As these are the only three species tested thus far, the recommendations in this document apply only to these three species.

The use of the 24-hour soak should not be discounted, as there have been no reported observations of negative effects using this method. There is a possibility that ageing, less vigorous seed lots may respond unfavourably to this longer period of extra stress but it has not been tested here. Any negative effects are speculative and would not apply to the vast majority of seed lots sown in Alberta, which fall within the 80-100% viability range.

The minimum recommended soak time for these three species is two hours. In instances where nursery managers require more schedule flexibility due to time, staffing or other resource constraints, limiting the imbibition time to a 2-hour soak will have no effect on germination rates, final seedling counts or quality.

For more information, please contact the Alberta Provincial Seed Specialist at the Alberta Tree Improvement & Seed Centre:

Lindsay Robb

Email: Lindsay.robb@gov.ab.ca

References

Alberta Seed Testing Standards 2016. Alberta Agriculture and Forestry, Government of Alberta. Edmonton.

FGRMS 2016. Alberta Forest Genetic Resources Management and Conservation Standards. Government of Alberta. Edmonton.