Tree Improvement Branch

Cone and Seed Improvement Program
BCMoF Tree Seed Centre

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Germination Retest Frequencies

Germination tests are initially performed on all seedlots prior to long-term storage. For registration seedlots must be between 4.0 and 9.9% moisture content and 97% + purity. Seeds are stored at -18°C to minimize seed deterioration. Quality seedlots with good vigour, germination capacity and rate can retain these characteristics for up to 30 years (and counting) in long-term storage. Seed deterioration occurs with ageing and theories range from the i) accumulation of deleterious products of metabolism ii) wear-and-tear of organelles, cells and organs making them inefficient over time and iii) increased mutation rates with ageing tissue causing metabolic malfunctions[1]. Seed deterioration may also be caused by fungi, bacteria, or insects, but the impact of these organisms is considered minimal for dry seed in long-term storage, as most require elevated temperatures and/or elevated moisture levels for active feeding or growth. The final outcome of seed deterioration is the inability of a seed to germinate under any conditions. Prior to seed mortality seeds will decrease in vigour and this trait will be variable for different seeds within a seedlot. Decreased seed vigour can be recognized by a reduction in germination speed, an increase in proportion of abnormal germinants, and increased sensitivity to sub-optimal conditions (e.g. temperature).

Seedlots are retested after a period of storage to ensure the germination capacity and seedling potential of a seedlot is current. The retest frequencies are directly related to the estimated deterioration rate of a species. Species and seedlots both show variability in the rate of deterioration. The objective of this note is to present a simple means of calculating the deterioration rate and present the average deterioration rates of BC conifer species. The deterioration rate of a seedlot is calculated as:

Deterioration Rate = (Current Germination% - Initial Germination%) / (Time in storage)

The units of the deterioration rate are % change in germination per year by using years as the unit of time[2]. For each species a deterioration rate was calculated as the average of all seedlots having a storage duration of greater than 500 days (Table 1). This restriction was used as small changes in germination, due to sampling variability, over a short time period can result in an erroneous deterioration rate being calculated (e.g. a four percent difference in germination for tests performed 6 months apart estimates a 8% rate of deterioration per year). For several species (Ba, Bg, Bl, Py) the germination test type has changed over time and various estimates of species deterioration were performed and averaged to produce the species deterioration rate. The deterioration rates ranged from a 1.44% decrease in germination per year for western redcedar to a gain of 0.67% per year for subalpine fir. Several species showed positive deterioration values and although these appear 'unrealistic' they are probably explained by sampling variation, erratic historical retest frequencies, improvements in seed testing procedures over time, and possibly by

[1]McGee, D.C. 1983. Introduction. Phytopathology: 73: 314-315. From Symposium: Deterioration Mechanisms in Seeds. 73rd Ann. Meet. Amer. Phytopathological Soc. New Orleans, LA. Aug. 3, 1981.
[2] actually used days between tests and then divided by 365 to put on a yearly basis

changes in seed dormancy during storage. The deterioration rates are being used as guides to prioritize our retesting of seedlots in storage. Using the deterioration rate, sample sizes, previous retest frequencies, feedback from clients and Quality Assurance monitoring the new retest frequencies were recommended and implemented for each species (Table 1). The retest frequencies range from 18 months (Cw) to 42 months (Plc and SS). For all *Abies* sp. the available data reflects only a short period of storage for any particular germination test and recommended retest frequencies are more conservative than the deterioration rates would suggest (especially with Bl) .

Table 1. Deterioration rates, sample sizes and retest frequencies for conifer tree seed.

Species	**Sample size**	**Deterioration Rate (DGC/yr)**	**Retest Frequency (months)**
Ba - Amabilis fir	85	-0.78	24
Bg - grand fir	40	-0.24	24
Bl - subalpine fir	50	+0.67	24
Cw - western redcedar	248	-1.44	18
Fdc - coastal Douglas-fir	264	+0.03	39
Fdi - interior Douglas-fir	402	-0.07	39
Hm - mountain hemlock	33	-0.36	24
Hw - western hemlock	272	-1.22	20
Lw - western larch	95	-1.06	22
Plc - coastal lodgepole pine	34	+0.08	42
Pli - interior lodgepole pine	756	-0.01	36
Pw - western white pine	77	-1.03	30
Py - Ponderosa pine	62	-0.28	30
SS - Sitka spruce	97	+0.10	42
Sx - interior spruce	820	-0.07	36
SxS - Sitka X interior hybrid spruce	62	-0.25	30
Yc - yellow-cedar	15	+0.46	36

These retest frequencies automatically assign a pending retest for all seedlots with a minimum balance of 5000 potential trees. Approximately 1000 seedlots will be retested this year. Seedlots are being prioritized based on seedlot size, seed quality and seedlot usage. If you would like information on a seedlots retest status, performance or to request a germination test please contact the Tree Seed Centre (604) 541-1683.

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