

Viability of several species of conifer seeds after long term storage

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Over the years, there have been a number of reports written on the storage of conifer seeds over a long period. Almost all of the studies have been conducted under laboratory storage conditions. It might be of interest to some nurserymen to have some data on long term storage of conifer seeds under routine production procedures. This article presents information from this point of view. Unfortunately, when an attempt is made to collect data from records that have not been designed for an experiment, some information will be missing. This occurs because of personnel changes, change of equipment, etc. However, even though some data are missing from the production records used for this study, they are adequate to indicate

how seed viability is maintained under routine cold storage and handling procedures.

It is pertinent at this point to describe the methods and equipment used in seed handling and the cold storage of seed at the Mont Alto Nursery.

The seed is stored in glass carboys (12- or 13-gallon capacity). The carboys are sealed with a cork stopper over which wax is applied. The seed is stored in these containers under refrigeration at 33-35° Fahrenheit. No attempt is made to control relative humidity as the carboys are air tight.

The moisture content of seed is measured with an Ohaus moisture meter. For the conifers listed in this report, the heating element is positioned 1/4 inch above the seed and the heater is set at 55 (temperature is 105° Centigrade) for 22 minutes. Every effort is made to store seed of these species at a moisture content between 6 and 9 percent.

A regular seed testing program was instituted in 1957 using a Dalite germinator set at 86° F for 8 hours with lights on and 68° F for 16 hours with lights off. The seed samples for testing are removed from the carboys with a seed trier. Under this type of sampling method, the germination percent difference between samples normally is between 6 and 7 percent.

During the storage period, 1957 to 1975, several things occurred that probably had an effect on seed viability. First, the cold storage equipment was out of service for several days two or three times and the air temperature climbed to about 18° F. The temperature of the seed within the glass carboys probably did not rise that much, but it probably did go up to -10° F or a little higher. Second, different containers were opened throughout the period to remove seed samples for testing. Although they were resealed, it is possible that some moisture did get into the carboy at this time.

Table 1. Data on the Seedlots Used for the Report

Species	Lot No.	Source	Date Collected	Date Received	Purity percent	Clean Seed/Lb.	Total Yrs. in Storage	Moisture Content percent	
								Pre-Storage	End of Storage
Larix decidua	75A	Sudetes	1956	05/02/57	85.5	86,710	12	9.3	..
Pinus banksiana	43A	Lake States	Fall 1955	10/25/56	96.1	129,788	19	8.8	9.3
Pinus banksiana	43B	Lake States	Fall 1955	12/20/56	82.2	137,852	19	8.4	9.0
Pinus banksiana	78	Unknown	Fall 1956	05/22/57	96.6	104,985	18	6.0	7.5
Pinus nigra	101	Lower Austria	Fall 1958	03/03/59	99.9	26,267	9	6.6	..
Pinus strobus	167	Clearfield Co., PA	Fall 1965	Fall 1965	93.4	24,920	10	7.2	..
Pinus strobus	205	Clearfield, Clarion & Jefferson Cos., PA	Fall 1967	12/21/67	87.6	23,715	8	7.3	7.0
Picea abies	92	Adirondack Mts., NY	Fall 1957	06/16/58	96.5	56,462	17	8.4	8.3
Picea abies	104	Central Europe	1958	04/06/59	99.7	60,444	16	7.7	7.4
Picea abies	170A	Centre Co., PA	Fall 1965	01/03/66	97.0	46,743	9	7.1	6.6

Even with cold storage breakdowns and occasional opening of the containers, most seed held up well in storage (table 2). It should be noted here that we had other lots of seed that were stored for long periods as well as the ones cited in this report. However, they were sown in less than an 8 year period and are not included in the data.

Table 1 contains data on the seedlots used for this report, and also the moisture contents of the seed.

Table 2 contains germination test results over the years. When the data are perused, please keep in mind that the same container might not have been sampled each year. One or two containers were selected at random each year to be sampled. This adds to the variability of germination results from year to year, and could also account for a greater than normal sample variation.

There is an indication that some of the lots were slowly losing some viability toward the end of the storage period recorded. How much longer these lots could be stored under the conditions used at Mont Alto Nursery without serious losses in viability is not known at this time. However, it should be noted that six of these lots are still available for production and further information can be gathered on them.

Table 2.—Germination Test Results

Species	Lot no.	1957		1958		1959		1960		1961		1962		1963		1964		1965		1966		
		Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	
<i>Larix decidua</i>	75A	49.25	...	41.75	56.00	52.75	...	46.75	53.00	44.00	...	48.25	47.75	50.50	48.00	49.75	50.25	...	...	51.50	48.00
<i>Pinus banksiana</i>	43A	87.00	...	...	...	...	...	83.50	1.00	90.00	...	87.50	1.75	83.75	2.75	76.50	0.75	...	...	84.50	9.25
<i>Pinus banksiana</i>	43B	...	...	91.00	...	94.75	0.75	90.75	1.50	91.00	...	83.00	4.50	84.25	8.25	77.75	2.75	...	...	86.00	6.25
<i>Pinus banksiana</i>	78	86.75	...	...	...	84.00	...	83.50	2.75	...	...	85.25	3.75	84.25	3.50	79.75	1.50	...	...	87.50	7.00
<i>Pinus nigra</i>	101	...	...	...	...	92.25	0.50	92.50	1.75	91.75	...	88.00	3.25	72.75	5.75	89.50	2.75	...	...	89.75	3.50
<i>Pinus strobus</i>	167	90.25	7.50
<i>Pinus strobus</i>	205	94.00	2.50
<i>Picea abies</i>	92	...	...	70.00	1.25	...	...	78.00	0.50	...	...	69.25	2.50	66.00	...	76.00	3.25	...	...	71.75	7.50
<i>Picea abies</i>	104	...	...	...	...	91.00	...	87.00	0.00	87.75	...	84.50	0.25	86.50	4.75	84.50	2.00	...	...	90.75	2.50
<i>Picea abies</i>	170A	91.25	7.50

Species	Lot no.	1967		1968		1969		1970		1971		1972		1973		1974		1975	
		Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent	Germ. percent	Hollow percent
<i>Larix decidua</i>	75A	48.75	51.25	44.75	50.00	43.25	49.00	...	...	...	...	...	...	...	...	...	...	...	...
<i>Pinus banksiana</i>	43A	79.75	7.50	81.25	3.00	79.75	5.75	79.50	12.50	79.50	5.50	81.25	5.75	83.50	7.75	81.25	5.00	83.75	6.75
<i>Pinus banksiana</i>	43B	82.00	5.50	81.75	6.50	79.50	8.75	85.75	3.25	84.25	2.00	79.25	9.50	85.00	7.75	82.25	7.25	83.75	6.00
<i>Pinus banksiana</i>	78	81.75	4.25	80.25	5.75	77.50	7.25	78.00	8.75	75.50	9.25	77.75	7.50	74.25	9.50	74.00	11.50	73.75	6.75
<i>Pinus nigra</i>	101	90.75	1.75	90.75	1.50	...	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Pinus strobus</i>	167	91.25	1.50	89.25	2.00	86.00	2.25	78.25	1.25	86.25	1.25	90.50	1.50	90.50	0.75	93.25	1.25	93.50	0.25
<i>Pinus strobus</i>	205	...	...	74.00	20.00	70.25	16.50	76.25	13.25	77.00	10.25	83.25	9.75	77.50	18.25	74.25	13.25	79.00	12.25
<i>Picea abies</i>	92	62.75	2.00	62.00	3.00	67.50	6.75	60.00	4.00	59.50	2.75	67.75	3.75	...	...	...	...	...	...
<i>Picea abies</i>	104	85.00	1.75	84.00	2.00	87.50	2.25	76.50	3.75	83.00	1.75	84.50	2.00	85.50	3.00	80.50	4.00	79.25	3.75
<i>Picea abies</i>	170A	91.00	3.75	92.00	3.50	91.50	4.50	91.00	1.50	94.50	1.75	92.75	2.50	83.50	6.50	93.75	3.50	92.75	3.75

Notes:

1. For all white pine germination tests there was a cold stratification for 30 days. There was no pretreatment for all other species.
2. The percent germination reported in table 2 is the average for four 100 seed replicates. The test medium was a blotter on top of Kimpak.
3. The two white pine lots in the report had higher than normal hollow seed percentages. Hollow seed percent for this species usually is between 3 and 5.
4. The samples for the tests each year were not always taken out of the same container.