National Tree Seed Centre

Annual Report

2002

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Natural Resources Canada
Canadian Forest Service - Atlantic
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INTRODUCTION

This report is the fifth covering the activities of the National Tree Seed Centre (NTSC). Similar reports were prepared from 1998 -- 2002. The purpose is to provide a summary of the activities of the NTSC for 2002. The report also captures the results of tests and experiments that were conducted by staff during the year in order to assure that this information is not lost.

The NTSC is a major component of the National Forest Genetic Resources Centre. It was established in 1967 at the Petawawa Research Forest (PRF) in Ontario and was transferred to the Atlantic Forestry Centre in Fredericton, New Brunswick in 1996. The mandate of the NTSC is to: obtain, store, and provide seed of known origin and quality for forest research; carry out baseline research on seed of Canadian tree and shrub species; and preserve germplasm obtained from rare, endangered, and/or unique populations for gene conservation.

Seed is stored in four different categories: Seed Bank, Reserved, Tree Breeding, and Gene Conservation (Table 1). The total number of seed lots increased by 535 to 11 370 in 2002.

Table 1. Seed stored at the NTSC as of December 31, 2002.

Seed Bank		Reserved		Tree Breeding		Gene Conservation	
# Species	# Seedlots	# Species	# Seedlots	# Species	# Seedlots	# Species	# Seedlots
195	4 367	43	1 807	35	3 785	9	1 411

Seed Bank seed lots are defined as those that are available for distribution. One of the objectives of the NTSC is to obtain seed samples of Canadian tree and shrub species from across their natural ranges. As of December 31, 2002, the NTSC Seed Bank had 125 Canadian species (4 013 seed lots) in storage (Table 2). An additional 92 exotic species (352 seed lots) are also stored. With the mandate of the Centre now concentrating on seed from Canadian tree and shrub species, the proportion of seed from exotic species is decreasing although some opportunistic acquisitions may still be made.

Since the Seed Centre moved to Fredericton, staff have concentrated their efforts in acquiring collections from New Brunswick, Nova Scotia, and Prince Edward Island. Travel beyond the Maritime provinces is difficult due to limited resources (staff and budget). There is an ongoing effort to acquire seed from other provinces and Seed Centres whenever the opportunity presents itself. The NTSC needs to make an effort to increase it's number of seed lots west of Ontario. Since collections by NTSC staff are unlikely due to distance and costs, these seed lots will have to be purchased or obtained through donation.

SEED COLLECTIONS IN 2002

The cool damp spring of 2002 delayed seed maturation. This made optimal seed collection time extremely difficult to predict. As a consequence, some seed may have been collected too early. A heavy rain and wind event that occurred when the seed were ripe knocked most of the seed off the red maple.

Collections of willow and poplar which were made when the catkins were just beginning to open showed poor germination with a high number of abnormal germinants. Seed quality was markedly better when seed was collected when the catkins were more mature (actively shedding or partially spent).

Drying seed collected in the spring has been a problem in the past. This is especially important when processing willow and poplar as these seed deteriorate very quickly and must be promtly stored in order to ensure long-term viability. The relative humidity (RH) of a room inside the lab was lowered by removing moisture with a de-humidifier. This lowered the RH by 15-20%.

The hot dry summer of 2001 resulted in good to excellent seed crops in many species. A total of 367 collections from 35 species was made in 2002. One notable activity was 75 single-tree eastern hemlock (*Tsuga canadensis*) collections from five old-growth sites in New Brunswick and Nova Scotia. The hemlock collections were made as part of a collaborative ongoing study of old-growth hemlock. Other important collections included 36 red maple (*Acer rubrum*), 24 white birch (*Betula papyrifera*), 39 balsam fir (*Abies balsamea*), 16 bracted balsam fir (*Abies balsamea* var. *phanerolepis*), 21 black ash (*Fraxinus nigra*), 20 white ash (*Fraxinus americana*), 19 black cherry (*Prunus serotina*) and 13 sugar maple (*Acer saccharum*) (Table 3).

SEED REQUESTS

Although the NTSC was established in 1967, database records of seed requests are not available from 1967 to 1982. However, since 1983, the number of requests for seed has ranged from a low of 17 in 1996 to a high of 156 in 1986 and 1987 (average 89 per year) (Table 4). The number of seed lots supplied has ranged from 99 in 1996 to 1 603 in 1985 (average 794 per year). It is the policy of the Seed Centre to provide seed, at no cost, for scientific research. Seed is also provided on occasion to universities and other educational institutions for educational purposes and to arboretums.

Table 4. Number of requests and number of seed lots supplied by the Seed Centre since 1983.

Year	# Seed Requests (Clients)			# Seed lots		
	Canadian	Foreign	Total	Canadian	Exotic	Total
1983	54	31	85	558	214	772
1984	60	26	86	541	266	807
1985	93	30	123	1 305	298	1 603
1986	127	29	156	1 016	313	1 329
1987	137	19	156	688	177	865
1988	100	23	123	566	195	761
1989	78	20	98	427	188	615
1990	98	21	119	615	192	807
1991	72	30	102	773	120	893
1992	74	19	93	706	54	760
1993	75	16	91	564	246	810
1994	91	11	102	597	181	778
1995	44	9	53	316	116	432
1996	11	6	17	70	29	99
1997	37	15	52	655	87	742
1998	54	10	64	562	55	617
1999	47	11	58	419	69	488
2000	59	21	80	501	65	566
2001	33	26	59	1 309	46	1 355
2002	59	9	68	711	68	779
Average	70	19	89	645	149	794

SEED TESTING

Germination tests are performed on all freshly collected seed lots as well as seed lots in storage that have not been tested for several years. In most cases, due to small seed lot size, four replicates of 50 seed each are placed on moistened Kimpak in germination boxes. When larger seed is being tested, the number of seed is sometimes reduced. **Three hundred and fifty-three germination tests** were carried out in 2002. In addition, approximately 350 germination tests were carried out as part of special projects and experiments.

Table 6 shows the number of tests carried out by the NTSC since 1983. Some testing was carried out prior to 1983 (1970 – 82), however, the number of tests conducted was low and does not represent a fully operational lab. The reduction in the number of tests between 1994 and 1996 coincides with the transferring of the Seed Centre from Petawawa to Fredericton. These figures were not used for the calculation of averages.

Once a seed lot has been cleaned, the percentage of moisture is determined. Two replicates of approximately 1 to 2 grams each (for most species) are put in aluminum containers and placed in a forced draft oven at 103°C for 16 hours. Moisture content is then calculated using the formula (MC % = (Fresh Weight - Dry Weight)/Fresh Weight*100). The target moisture content for orthodox seed is between 5 and 8 percent. Seed that are above this range are further dried before being stored. **One thousand nine hundred and forty-six moisture content determinations** were carried out by NTSC staff in 2002. The high number of moisture contents in 2002 is the result of moisture contents done on most of the white spruce seed lots in storage. A total of 409 seed lots were conditioned (moisture content lowered to 5 – 8%).

Once moisture content is within acceptable limits, the 1000-seed weight is determined. This is carried out by counting and weighing eight replicates of one hundred seeds. When dealing with extremely small seed (birches, poplars, willows) fewer replicates are performed. When the collected sample is small (less than 800 seed), the total number of seed is counted, the total weight of the sample is determined, and the 1000-seed weight calculated. A total of **two hundred and seventy-seven 1000-seed weights** were done in 2002.

White Pine Seed Storage Experiment

The set-up and initial moisture content (MC) and germination results were reported in the 2001 Annual Report (Daigle and Simpson, 2002). Historical germination test data at the NTSC have shown that viability of white pine seed declines steadily up to 20 years of age. An experiment was started to evaluate the impact on viability by storing seed of various MCs at -20°C and cryogenically, in the vapor phase of liquid nitrogen, at -145°C.

Cones were collected in September 2000 from three trees in the UNB Woodlot in Fredericton and three trees in the UNB Noonan Woodlot (15 km east of Fredericton). Seed was shaken from the cones, debris and dirt removed, seed de-winged by hand rubbing, and full seed separated from empty seed by floatation in 100% ethanol. Moisture content of the seed from each tree was determined by weighing two replicates of two grams, placing the seed in a forced draft oven for 16 hours at 103°C, and weighing the dry samples. These MCs were designated as controls. Seed was then treated to achieve the three other MCs of 5, 8, and 11%. A sample from the control for each seed lot was placed in a forced draft oven set at 30°C and weighed periodically until its weight reflected the target MC of 5%. Likewise, samples were taken from each control and placed in fine mesh screen trays placed over water in germination boxes. Weights were periodically recorded for a sub-sample until the target MCs of 8 and 11% were achieved. As each sample reached its target moisture content it was quickly placed in a 10 ml cryogenic vial and sealed.

After 11 months in storage one set of vials was removed. The vials were immediately placed at room temperature (21°C) and remained there for 22 hours. Approximately 1.2 – 1.5 grams of seed, depending on seed size and target MC, was removed from each vial for MC determination. There was only sufficient seed for one replicate. Moisture content was determined in the same manner as above. Average MC of the conditioned seed, prior to storage, was close to the MC classes (Table 7). The control MC was higher than the lower target MC of 5%. On average, MC of the seed was higher after 11 months in storage especially for the control and 5% seed lots stored at -20°C. Seed lots stored at -145°C exhibited less of an increase in MC except at the higher target MC of 11%. One could expect MC to be slightly different after storage due to some variation among samples during conditioning. The cryogenic vials are fitted with an o-ring which should create a tight seal ensuring that the seed does not gain or lose moisture. At least 20 hours passed from the time the samples were removed from storage and placed at room temperature so the seed was sufficiently warm to avoid moisture condensing on the surface when the seed was removed from the vials. Less than 10 seconds passed from the time each vial was opened, seed poured out, and the weight recorded. Therefore, there is no readily available explanation as to why MC increased other than variation in initial MC among the samples at the time of storage. It will be interesting to monitor this in the future when the next set of samples is tested.

The remaining seed was used for the germination test. Seed was placed on moistened Kimpak in Petawawa germination boxes using a vacuum plate. Four replicates of 50 seed each were placed in each box. The boxes were transferred to a cooler maintained at 4°C for 28 days. After 28 days the boxes were placed in a Conviron G30 germinator. Germination conditions were 30°C with 8 hours

Table 9. Analysis of variance of germination of white pine seed stored for 11 months.

Source of variation	d.f.	Mean Square	F value	P value
Population (P)	1	5.5909	118.69	< 0.0001
Seed lot (population)	4	0.6082	12.91	< 0.0001
Moisture content (MC)	3	0.2491	5.29	0.0018
Storage temperature (ST)	1	0.0295	0.63	0.4305
Replication (R)	3	0.1356	2.88	0.0386
P x MC	3	0.245	5.2	0.002
P x ST	1	0.286	6.07	0.0151
P x R	3	0.0818	1.74	0.1628
Seed lot x MC	12	0.0741	1.57	0.1071
Seed lot x ST	4	0.0144	0.31	0.873
Seed lot x R	12	0.0643	1.36	0.191
MC x ST	3	0.0346	0.73	0.5336
MC x R	9	0.0375	0.8	0.6203
ST x R	3	0.0965	2.05	0.1102
Error	129	0.0471		

Testing will be repeated again after seed has been in storage for 36 months. Subsequent testing frequencies will depend on the results at 36 months.

Daigle, B.I., and J.D. Simpson, 2002. National Tree Seed Centre annual report 2001. Nat. Res. Can., Can. For. Serv. – Atl., 46 p.

Wang, B.S.P. 1973. Laboratory germination criteria fro red pine (Pinus resinosa Ait.) seed. Proc. Assoc. Off. Seed Anal. 63: 94-101.

Results presented here are for the complete 36 month storage period (Figures 1 - Tree 1 and 2 - Tree 3). There were only sufficient acorns collected from two trees to allow testing every 6 months. Generally, there was less surface mold (white in color) on acorns in sub-zero storage than on those in above zero storage. Whether this had an impact on acorn survival is not definite. There is much more variation in germination during the first 24 months for acorns of Tree 3 stored at 4°C than for Tree 1 with acorns from Tree 1 storing better at both storage temperatures. Taking both trees into consideration, acorns stored better at -2°C with acorns stored in polybags storing best, on average.

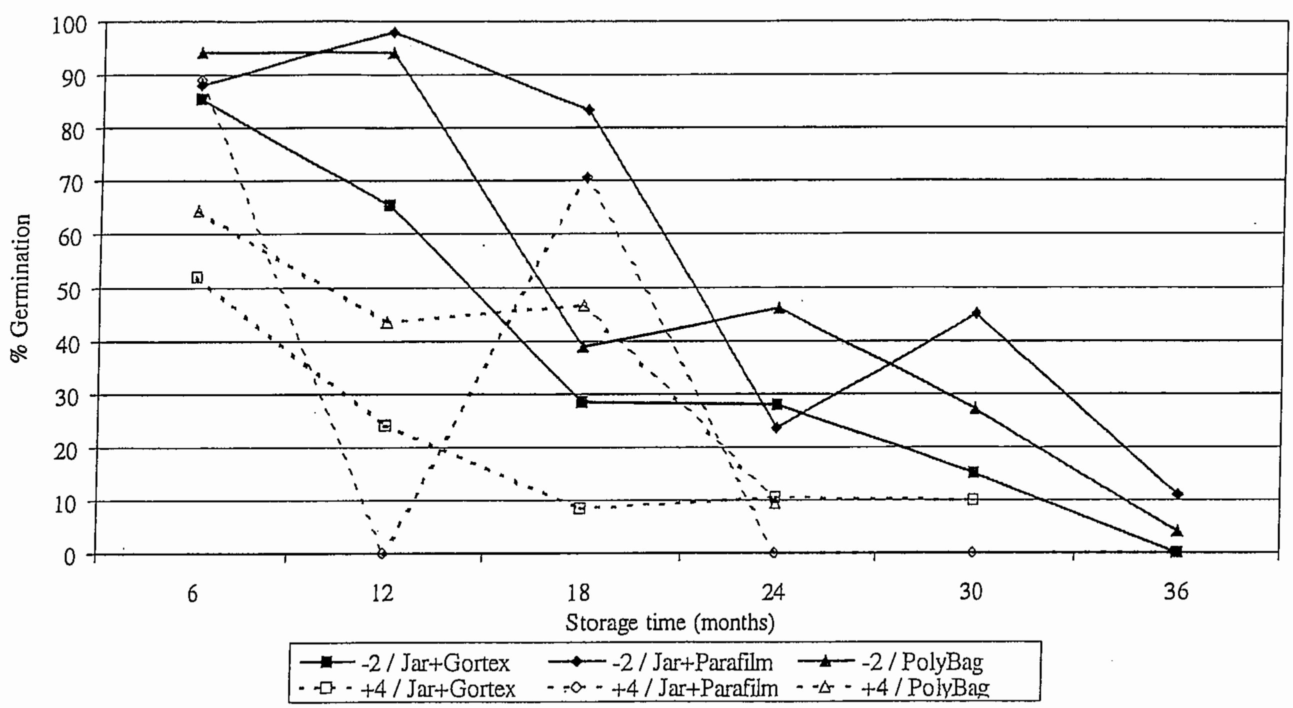

Figure 2. Germination of red oak acorns from Tree 3 stored at two temperatures in different containers.

Moisture content (fresh weight basis) of acorns from both trees tended to increase following storage (Figures 3 and 4). Variation in acorn MC among the containers and storage temperatures increased for Tree 3 (Figure 4) after 18 months and resulted in a 10% difference between the two extremes by 30 months. At 36 months, the difference was 20% between the two extremes. In contrast, for Tree 1 (Figure 3), with the exception of acorns stored at 4°C in Gortex covered jars, the MCs of acorns were just over 40% at 36 months. It has been stated in the literature that a MC of 40% is considered optimal for acorn storage and this is best demonstrated by acorns from Tree 1 having higher germination. Why the moisture content of acorns from Tree 3 stored at 4°C in polybags continued to rapidly increase after 18 months is unknown. One possible overall bias was that the acorns from which MC was determined consisted of dead, spore filled, and healthy acorns. Spore filled acorns

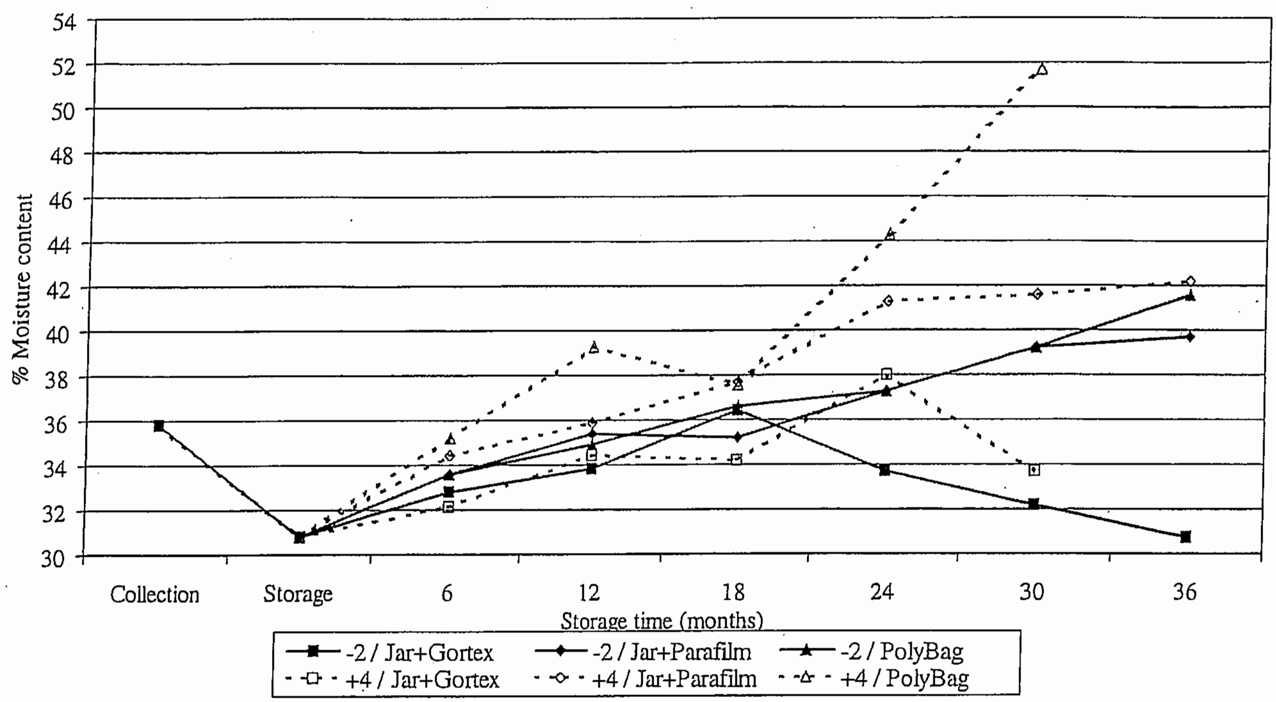

Figure 4. Moisture content of red oak acorns from Tree 3 stored at two temperatures in different containers.

Daigle, B.I. and J.D. Simpson. 2001. National Tree Seed Centre annual report 2000. Nat. Res. Can., Can. For. Serv. – Atl., 40 p.

Daigle, B.I. and J.D.Simpson. 2002. National Tree Seed Centre annual report 2001. Nat. Res. Can., Can. For. Serv. – Atl., 46 p.

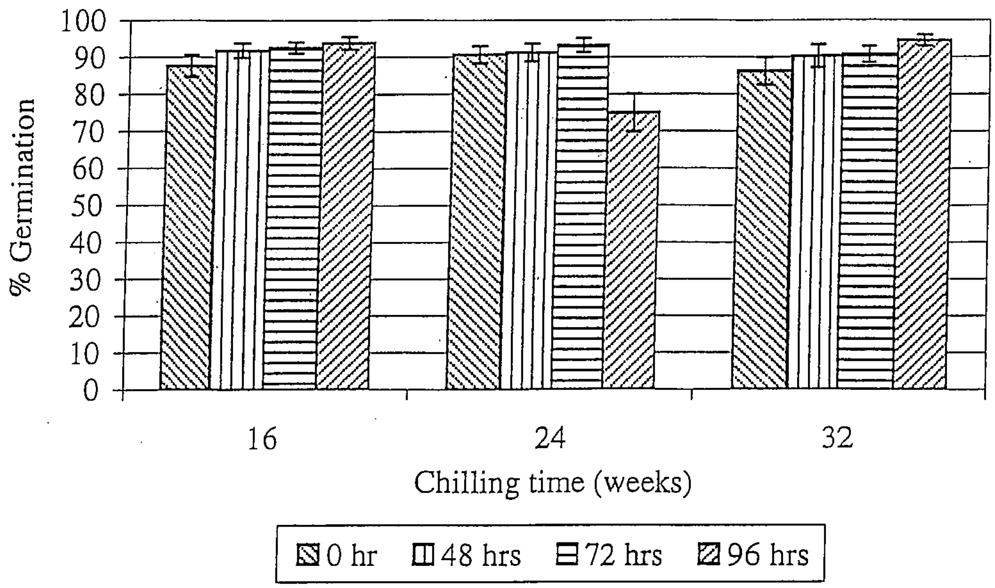

Figure 6. Germination of striped maple seed soaked for four durations, moist chilled for three time periods, and germinated at 5°C/15°C.

The results from this project now provide the Seed Centre with a useful prescription to use for testing striped maple seed. Additional testing using different germination temperatures would be useful to determine what the optimum temperature might be.

Many of the seed showed radicle emergence while being moist chilled at 4°C. This breaking of dormancy did not occur at the same time for the various seed lots. The seed lot from Ontario was the first to break dormancy with 16% of the seed having radicle emergence after 9 weeks. Two of the Maritime seed lots had no radicle emergence while the third had 2% emergence (Table 10). All seed lots showed an increase in radicle emergence after 12 weeks and, with the exception of the Ontario seed lot, the trend continued to 15 weeks.

Table 10. Radicle emergence (%) of four sugar maple seed lots after 9, 12, and 15 weeks moist chilling.

Seed lot #	Moist chilling		
	9 weeks	12 weeks	15 weeks
9230089	16	18	16
9910115	0	60	98
9910116	2	72	89
20001124	0	25	65

Germination after 9 weeks was poor with many ungerminated seeds appearing fresh when cut. With the exception of the seed lot from Ontario, results after 12 and 15 weeks improved significantly with the number of "fresh" seeds decreasing as moist chilling increased (Table 11). Generally, germination temperature had no consistent impact.

Table 11. Germination (%) of four sugar maple seed lots at two germination temperatures after 9, 12, and 15 weeks moist chilling.

Seed lot #	Moist chilling (weeks)					
	9 weeks		12 weeks		15 weeks	
	20°C	20/30°C	20°C	20/30°C	20°C	20/30°C
9230089	11	18	11	18	13	10
9910115	8	11	81	88	97	98
9910116	8	10	81	81	89	87
20001124	0	6	28	33	69	52

Silver Maple Storage Experiment

Silver maple (*Acer saccharinum* L.) seed is recalcitrant in nature and long-term storage using traditional means is not possible. Based on information contained in the NTSC database, seed viability increases rapidly once moisture rises above 35%. Optimal results appear to occur when moisture content exceeds 43% (Figure 7). In the past, seed has been stored in glass jars at 4°C. Under these conditions, seed viability can only be maintained for up to six months.

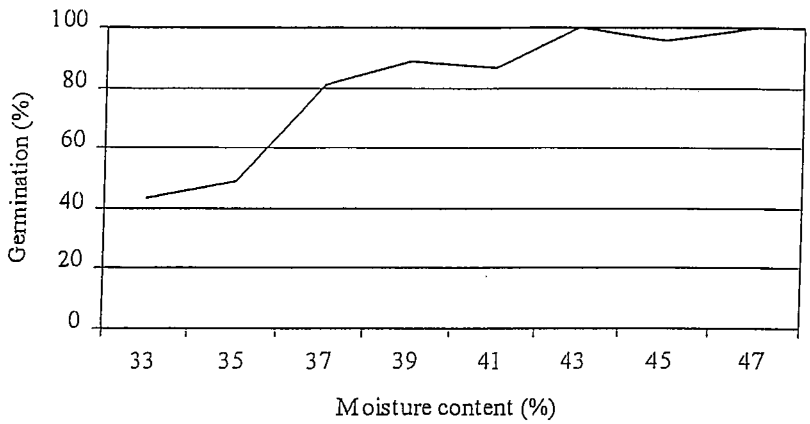

Figure 7. Germination (%) of fresh silver maple seed at different moisture contents.

Two silver maple seed lots (20021019 and 20021020) were collected in June 2002. Seed was brought into the lab and processed. Moisture contents and germination tests were performed on the fresh seed. Moisture contents were 38 and 41% and germination was 97 and 86% for seed lots 20021019 and 20021020, respectively. Five replicates from each seed lot, consisting of approx. 150 seed each, were placed in 250ml Mason jars, sealed with parafilm and stored at 4°C and -1°C. Sufficient seed is stored to allow testing (moisture content and germination) at 3, 6, 12, 18, and 24 months.

The results included here represent testing carried out at 3 and 6 months (Table 13). As expected, viability of the seed stored at 4°C is not being maintained. Although germination of the seed stored at -1°C is also decreasing, the rate of decrease is slower and the vigour of the germinants is better. Moisture content of the seed stored at -1°C appears to be remaining constant while the moisture content for seed at 4°C is increasing. Although inconclusive at this time, further testing is planned for 2003. An experiment with a wider range of moisture contents and storage temperatures below -1°C may provide better results.

De-Winging and Alcohol Separation of Green Alder

Two separate experiments were conducted with green alder (*Alnus viridis* ssp. *crispa* [Ait.] Turrill) seed. The first experiment consisted of comparing germination of winged and de-winged seed from three seed lots. Seed was de-winged by rubbing in a cloth bag and using sieves and an air aspirator to remove the crushed wings and some of the lighter seed. Samples of winged and de-winged seed were tested by placing two replicates of 100 seed each on moistened Kimpak in Petawawa germination boxes and putting them in a germination cabinet set at 30°C for 8 hours light and 20°C for 16 hours dark and constant relative humidity of 85% for 21 days.

Mean germination for the winged seed was 36% as compared to 76% for the de-winged seed. (Figure 8). The de-winging process did not appear to damage the seed. De-winging makes it possible to separate damaged and light (empty) seed from the heavier filled seed using air separation. This is not possible with winged seed since the surface area makes it impossible to separate using this method.

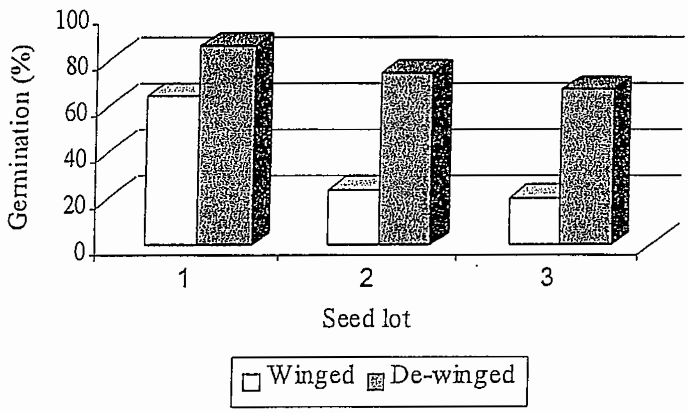

Figure 8. Germination (%) of winged and de-winged green alder seed.

The second experiment involved alcohol floatation (100% ethanol) of four seed lots to determine how effective this treatment would be in removing empty seed. Alcohol separation has been successfully used to separate white birch seed (Daigle and Simpson, 2002). The seed lots used for this experiment were not tested prior to being treated with alcohol. The seed was de-winged as described above and immersed in ethanol. Seed that floated and seed that sank were rinsed in tap water and dried before being tested. Germination tests were set up as described above. Results showed that the seed that sank in ethanol had a much higher germination (average 76%) than those that floated (average 6%) (Figure 9). Furthermore, the floating seed that did germinate displayed low vigour which may be an indication of damaged or immature seed.

Impact of Moisture Content on Viability of White Spruce Seed

The NTSC has a large inventory of white spruce seed lots. This collection includes approximately 1 500 single-tree seed lots with some collections dating to the mid 1950's. This collection is an operational collection in that it is not set up as a controlled storage experiment. Seed is removed from storage to provide seed for research and testing. Although precautions are taken when removing seed from storage, seed quality may be affected by exposing the seed to heat and moisture.

Initial seed quality information such as moisture content and germination is not available for many of the older seed lots. Consequently, the data set for these seed lots is not complete. In order to assess the information that is available, it is necessary to use a starting point other than when the seed lot was collected.

The objective of the following assessment was to look at the effect of moisture content on the storage capability of the seed. Since this was not set up as a storage experiment, the changes in the condition of the seed during storage were not always known. Also, the testing of the seed was not always carried out systematically. For example, a seed lot may have had a moisture content of 4.0 % when it was first stored and that moisture content may have increased during storage or when the seed lot was removed from storage for testing or to provide seed. The seed lot may then have been conditioned (dried down) and stored again. It is impossible to determine ~~the length of time the~~ moisture content of the seed lot was elevated. This assessment only looks at the highest moisture content the seed achieved during storage and relates this to the loss in germination over time.

During 2000 – 2002, all of the white spruce seed lots in storage were tested (moisture content and germination). Information on these seed lots varies from very good to poor. Sufficient information exists on some sub-sets to draw some interesting observations on storage behaviour.

Two sub-sets were used: seed lots collected in the 1970's and seed lots collected in 1984. All of these seed lots are single-tree seed lots from Ontario that were stored at -20°C. The data from the 1984 collections are easier to assess as all of the seed lots had germination and moisture content done shortly after extraction. Some of the seed lots from the 1970's were tested after extraction but many were not tested for several years. As a result of this "imperfect" data set, it was necessary to use maximum values for moisture content and a loss of viability based on the earliest known test results. Although this method of assessment has its drawbacks, it still provides some useful information on the effect of moisture content on stored seed.

The data set for the 1970's contained 207 seed lots. The maximum moisture content during storage ranged from 4.7 – 10.3% (mean of 6.5%) and germination results from the earliest test ranged from 51 – 100% (mean of 93.3%) while germination at the end of the test period ranged from 20 -- 99% (mean of 73.8%). The results show that viability loss per year remained constant below 0.5% until moisture content exceeded 9% (Figure 10).

Although maximum moisture content was used as a criterion, it cannot be determined how long the seed remained at this moisture content. This assessment only shows that exposure to these high moisture contents for any length of time damages seed. An interesting follow-up to this would be to set up a controlled experiment where seed of high moisture is stored for varying amounts of time and then conditioned and see what effect lowering the moisture content has on the seed.

The seed lots from the 1984 collections had original moisture contents that can be considered very low. This does not appear to have damaged the seed. A closer look at the data shows that seed lots with a moisture content that remained between 2.5 – 3.4% for 18 years had an annual viability loss of 0.21% while those between 3.5 – 4.4% showed a 0.27 loss. These calculations are based on samples of 54 and 102 seed lots, respectively.

In order to build a comprehensive database for future evaluation, the NTSC is adopting the policy of determining seed moisture contents every time germination tests are performed.

Table 14. Moisture content and germination (%) of white spruce seed before storage and after 27 years storage at -20°C and 4°C.

Tree #	Before Storage		Stored 4°C		Stored -20°C	
	MC (%)	Germ (%)	MC (%)	Germ (%)	MC (%)	Germ (%)
7431280	4.2	97.2	9.6	0.0	6.9	94.0
7431290	4.3	99.2	10.0	0.0	5.2	99.5
7431300	4.1	93.2	6.2	52.0	5.1	89.5
7431310	3.6	98.8	5.6	29.5	4.9	98.0
7431320	4.8	98.8	9.7	0.5	6.0	99.5
7431340	4.3	99.2	8.6	32.5	5.6	97.5
7431350	4.6	94.0	5.7	30.0	5.2	96.5
7431360	4.1	99.2	8.3	96.5	6.5	97.5
7431370	5.4	99.5	5.7	9.0	5.0	98.5
7431380	4.6	95.5	8.7	34.5	5.8	97.5
7431390	4.0	97.0	5.8	32.0	5.5	92.0
7431400	4.9	97.8	9.6	3.0	5.8	98.5
7431420	5.0	97.2	9.1	3.0	5.9	96.5
7431440	4.7	97.5	5.7	38.5	5.0	98.5
7431460	5.2	87.2	9.2	2.0	6.3	94.5
7431470	4.8	97.2	8.2	98.5	6.3	98.0
7431490	5.0	98.0	5.9	57.0	6.1	96.5
7431510	4.9	95.0	6.5	0.0	6.9	98.0
7431520	4.4	94.8	8.7	6.0	5.9	97.5
7431540	5.3	97.2	9.5	28.0	6.1	96.5
7431580	5.0	93.5	9.7	87.5	5.7	96.5
7431600	4.4	97.5	5.7	12.0	5.8	95.5
7431620	5.1	83.8	6.2	42.5	6.4	84.5
7431660	4.4	98.0	6.2	55.5	5.8	97.5
7431680	4.0	91.8	5.6	67.5	5.4	89.0
7431700	4.6	95.5	5.9	6.5	6.1	92.5
7431720	4.4	99.0	6.1	47.5	5.8	96.5

Based on this information, it would be useful to set up a germination experiment which would include both warm and cold stratification treatments and examine a range of cool germination temperatures.

AOSA [Association of Official Seed Analysts]1993. Rules for testing seed. Seed Technol. 16 (3). 113 p.

ISTA, 1996. International rules for testing seed. eed Sci. & Technol. 24, suppl.

Plants for a Future, 2003. *Acer spicatum*. [Online] Available: http://gardenbed.com/A/6203.cfm. [2003 February 4].

Zasada J. C. and T. F. Strong. 2003. *Acer* L. [Online] Available: http://wpsm.net/Acer.pdf. [2003 February 14]

* Seed was germinated at 10/15°C for most of the test period. However, there was a period where germination conditions were set at 5/15°C for the seed moist chilled for 16 weeks.

Lake and Shea Lake in New Brunswick as well as Victoria Park, Antrim, and Judique in Nova Scotia.

Seed will be processed in January -- February 2003. A germination experiment was set up to determine the most effective way of germinating the seed. This test involved 4 seed lots from 2 populations with 7 moist chilling periods and 3 germination temperatures. A secondary experiment was set up to assess the effect of ethanol on the seed. Ethanol is used to improve the quality of conifer seed lots and has also successfully been used on birch and alder seed. Eastern hemlock seed has resin vesicles on the surface and there is a concern about the effect alcohol might have on these and how this would impact the long-term quality of the seed. In order to determine this, an alcohol tolerance test was set up. The results from these tests will be provided in the 2003 Annual Report.

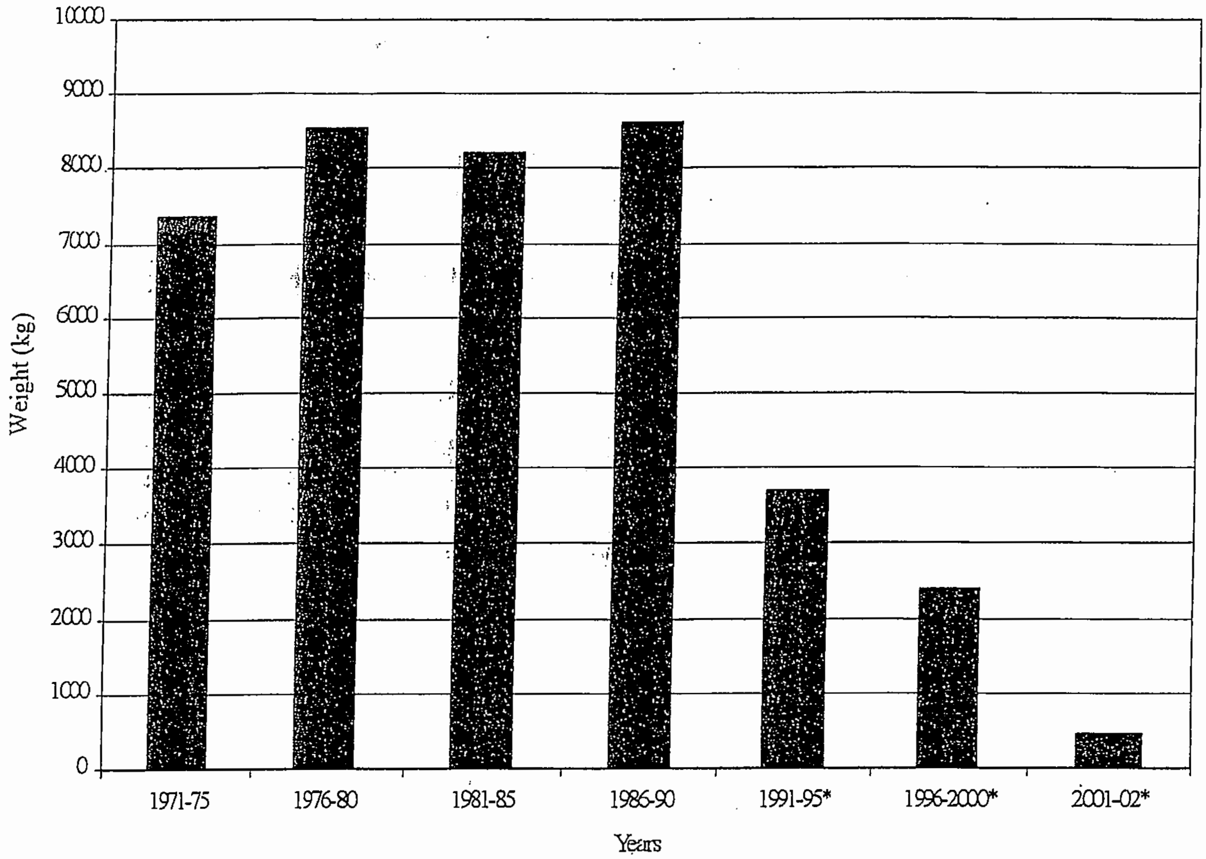

Figure 12. Weight of seed OECD certified or exported* by 5-year periods.

PROMOTION OF SEED CENTRE

Many opportunities arise throughout the year to promote the NTSC to clients and the public. Since the Seed Centre provides a service to the research community, it is important to take advantage of these opportunities when they occur. These opportunities present themselves through many venues including tours of the facility and participating in conferences or other meetings. The following highlights the activities in 2002.

Visitors to the NTSC in 2002 included: the Forest Nursery Practices (FOR 5912) and Plant Propagation (BIOL 2422) classes from the University of New Brunswick, students from the Maritime Forest Ranger School, UNB freshman class (forestry), private woodlot owner group from Spain, Portugal, and France, members of the Lennox Island band in PEI, finance managers from all CFS Centres, Chinese delegation from Jilin province, and chief foresters from New Brunswick licensees and sub-licensees.

Other activities included an Information Morning interview on CBC radio, a display in the Hugh John Flemming Forestry Centre during National Forestry Week, a presentation on germinating tree and shrub seed in the KC Irving theatre, a feature article on the national Tree Seed Centre in the Forest Health and Biodiversity News, and a reprint of our "Making A Difference" impact note,

The NTSC web site was launched in September, 2002 (www.atl.cfs.nrcan.gc.ca). The site contains an inventory of the seed available for research as well as information of collection, processing, testing, and storing of seed. A number of seed requests were received as a result of the web site and, with time, this number will increase.