National Tree Seed Centre

Annual Report

1999

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INTRODUCTION

The purpose of this report is to provide a summary of the activities of the National Tree Seed Centre (NTSC) for 1999. A similar report was prepared for 1998. 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 was established in 1967 at the Petawawa National Forestry Institute (PNFI) in Ontario. It 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 and gene conservation.

Historically, the NTSC has stored seed in four different categories: Seed Bank, Reserved, Tree Breeding, and Provenance Test (Table 1). A fifth category is being developed to store seed for gene conservation. To date, only two seedlots are stored in this category but an effort will be made to collect and store seed from rare and endangered native species and unique populations.

Table 1. Seed stored at the National Tree Seed Centre (as of August 3, 1999).

Category	# Species	# Seedlots
Seed Bank	215	3 143
Reserved	37	1 714
Tree Breeding	36	4 466
Provenance Test	6	1 365
Gene Conservation	2	2
Total	245	10 690

Seed Bank seedlots are defined as being 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 August 3, 1999 the NTSC Seed Bank had 123 different Canadian species (2 706 seedlots) in storage. An additional 110 exotic species (437 seedlots) are also stored. With the mandate of the Centre now concentrating on Canadian trees and shrubs, the proportion of exotics will decrease although some opportunistic acquisitions will still be made. The bulk of Canadian collections is from Ontario (Table 2). This is primarily due to approximately 700 seedlots from single-tree white spruce from the Ottawa Valley. Since moving to Fredericton, staff at the NTSC have concentrated their efforts in acquiring collections from New Brunswick, Nova Scotia, and Prince Edward Island. In future years, effort will be required to collect or acquire seed from more distant locations. There is an ongoing effort to acquire seed from other provinces and Seed Centres whenever the opportunity presents itself.

Table 2. Number of species and number of seedlots by province contained in the Seed Bank category.

Province	# Species	# Seedlots	%
Alberta	13	55	2.0
British Columbia	27	285	10.5
Manitoba	1	4	0.1
New Brunswick	50	430	15.9
Newfoundland	11	80	3.0
Nova Scotia	24	209	7.7
Ontario	66	1 364	50.4
Prince Edward Island	25	65	2.4
Quebec	12	143	5.3
Saskatchewan	9	27	1.0
Yukon Territory	2	43	1.6
Total		2 705	100.0

The Reserved category contains seedlots that have been reserved by researchers. Many of these seedlots were collected by the researchers for special projects. The main users of this service are researchers at CFS-Atlantic. (1 265 of the 1 712 seedlots). Other notable users are Mr. Ben Wang (130 seedlots) and Dr. Kristyna Klimaszweska (41 seedlots). There are 204 seedlots that are reserved with no indication of who they are reserved for. The remaining reserved seedlots are as follows: Burgess (41), Cummings (1), GCP (2), Hurley (16), Miller/Burgess (1), Mittal (7), OMNR (1), Rutledge (1), and Wetzel (2). Some clean-up of this category is necessary but is a low priority at this time.

The Tree Breeding category contains the largest number of seedlots. These originated from the genetics program at PNFI and were transferred to the Seed Centre for storage. Many of these have been stored in sub-optimal conditions for many years. Many of these seedlots are still being stored at 4°C. This seed is of questionable quality and must be tested before being stored at -20°C. Over time the better quality Tree Breeding seedlots are moved to the Seed Bank category as testing progresses. Some white spruce seedlots were tested in 1999. Of the 91 seedlots tested, 69 did not germinate. An additional 13 seedlots had very low germination (between 0.5 - 7%) and 4 seedlots had germination of between 10 to 25 %. Germination percentages of over 25 % were only obtained on 5 seedlots and these were transferred to the Seed Bank. Seedlots containing very small quantities were discarded.

The Provenance Test category is composed mainly of white spruce (1 347 out of 1 365) seedlots from the range-wide white spruce provenance tests established in cooperation with PNFI in the early 1980s. Most of these are 5 or 10 gram quantities contained in sealed plastic packets that have been placed in larger jars and stored at -20°C. Many of these seedlots are also stored in the Seed Bank (-20°C) and Tree Breeding (4°C) categories.

The Gene Conservation category is new to the Seed Centre. It was put in place to assure that genetic material obtained from rare, endangered and/or unique populations is preserved. The intent is to develop criteria for inclusion in this category. Material stored in this category will be of good quality and testing will be carried out on sub-samples of the material.

The NTSC does not store large quantities of seed from single seedlots. The emphasis is placed on acquiring many representative samples of the same species over the extent of that species' range. Consequently, many of the collections are relatively small in size. Table 3 gives a breakdown of the sizes of seedlots stored at the Centre. The number of small seedlots poses some challenges when it comes to testing and determining whether or not to keep these small samples (some seedlots only contain a few seeds). This is especially evident in the Reserved, Provenance Test, and Tree Breeding categories. Many of these are single tree seedlots which were collected for a specific project or experiment. Although some of the material has never been tested, it may represent important genetic material.

Table 3. Number of seedlots in various seed quantities by category stored at the NTSC (December 31, 1999).

Category	Quantity (grams)							Total
	> 500	100 - 500	50 - 100	10 - 50	5 - 10	1 - 5	< 1	
Seed Bank	82	899	618	1 125	239	156	24	3 143
Reserved	7	52	78	552	168	350	507	1 714
Tree Breeding	8	313	163	1 319	631	1 317	715	4 466
Prov. Test	-	5	-	-	885	450	25	1 365
Gene Cons.	-	-	2	-	-	-	-	2
Total	97	1269	861	2 996	1 923	2 273	1 271	10 690

COLLECTIONS IN 1999

Nineteen ninety nine was an "off" seed year for many tree species in the Maritime provinces. Thirty nine different species were collected in 1999 (139 collections). The majority of the collections were made in New Brunswick (100) with 37 collections coming from Nova Scotia and 2 from Prince Edward Island (Table 4). Methods used to collect seed ranged from picking seed directly from the tree or shrub, using the bucket truck, climbing, pole pruners, and collecting from the ground.

Although 1999 was considered to be a poor seed year, half the collections were from tree species. Several collections were made from three native poplars, red oak, basswood, sugar maple, beech, black spruce and jack pine. The sugar maple and beech were collected in Cape Breton which was the only location in the Maritimes that seed was produced from these species in 1999. The black spruce and jack pine, although collected in 1999 were not the result of seed produced during that year. The black spruce was collected during the winter and the jack pine, because of the serotinous nature of the cones, can be collected at any time.

The relative lull in activity provided the opportunity to collect seed from a variety of shrubs and also to seek out locations for collections in future years. Two hazel alder (*Alnus serrulata*) sites were located in New Brunswick near Meductic along the Eel River and near Saint Stephen along the Saint Croix River. Both these locations were provided by Dr. Hal Hinds. These two sites are the only known locations of hazel alder in New Brunswick. Although no seed was produced in 1999, there should be a crop at both locations in 2000 and seed will be collected. A small collection of sweet viburnum, also called nannyberry (*Viburnum lentago*) was made along the Mohannes River in southern New Brunswick. This is the only area in New Brunswick that this species can be found and represents the northernmost extent of its range. The site will be checked in 2000 in order to make a larger collection. A large collection of buttonbush (*Cephalanthus occidentalis*) was made in the Jemseg area. This population represents the northernmost extent of the range of this species. In addition, several species were collected for the first time by the NTSC. These included *Amelanchier laevis, Cornus obliqua, Crataegus chrysocarpa, Crataegus flabellata, Prunus pumila*, and *Salix eriocephala.*

Table 4. Collections made by Seed Centre staff in 1999.

Species	N.B.	N.S.	P.E.I.	Total
Acer pensylvanicum	0	1	0	1
Acer rubrum	1	0	0	1
Acer saccharinum	1	0	0	1
Acer saccharum	0	5	0	5
Alnus crispa	4	5	0	9
Amelanchier	1	0	0	1
Betula papyrifera	0	1	0	1
Betula populifolia	1	1	0	2
Cepahlanthus accidentalis	3	0	0	3
Cornus alternifolia	1	0	0	1
Cornus stolinifera	1	1	0	2
Crataegus chrysocarpa	0	1	0	1
Crataegus flabellata	1	1	0	2
Fagus grandifolia	0	3	0	3
Ilex verticillata	0	3	0	3
Juniperus communis	0	1	0	1
Nemopanthus mucronatus	1	0	0	1
Picea mariana	6	0	0	6
Pinus banksiana	10	4	1	15
Populus balsamefera	9	0	0	9
Populus grandidentata	9	0	0	9
Populus tremuloides	7	0	0	7
Prunus pensylvanica	2	0	1	3
Prunus pumila	1	0	0	1
Prunus serotina	7	2	0	9
Prunus virginiana	4	6	0	10
Quercus rubra	3	0	0	3
Rhus typhina	1	0	0	1
Salix bebbiana	3	0	0	3
Salix discolor	4	0	0	4
Salix eriocephala	2	0	0	2
Sambucus canadensis	4	1	0	5
Sambucus pubens	1	0	0	1
Sorbus decora	1	0	0	1
Tilia americana	4	0	0	4
Viburnum cassinoides	2	0	0	2
Viburnum lentago	1	0	0	1
Viburnum trilobum	3	1	0	4
Total	100	37	2	139

In addition to collections made by NTSC staff, seed was also acquired though donation (Table 5).

Table 5. Seedlots acquired through donation by the Seed Centre in 1999.

Species	Origin	# Seedlots
Betula papyrifera	British Columbia	18
Picea glauca	Quebec (CFS - Laurentian)	38
Pinus banksiana	Prince Edward Island	1
Pinus strobus	Quebec (CFS - Laurentian)	16
TOTAL		73

We also acquired a large shipment of seed from the Ministère des Ressources naturelles du Québec (Provincial Seed Centre in Berthierville) (approx. 750 seedlots from 12 different species). None of the seedlots from Berthierville have been entered in the database although we have started germination testing. Germination tests will determine which seedlots are kept and these will be included in next year's report. The quality of the seedlots varies from excellent to poor. The poorer seedlots will be discarded as space does not permit us to store low quality seed.

SEED REQUESTS

Although the NTSC was established in 1967, 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 93 per year) (Table 6). The number of seedlots supplied has ranged from 99 in 1996 to 1 603 in 1986 (average 776 per year). It is the policy of the Seed Centre to provide seed at no cost providing of course that the seed be used for scientific research. Seed is also provided on occasion to universities and other educational institutions for educational purposes and to arboretums.

Table 6. Number of requests and number of seedlots supplied by the Seed Centre since 1983.

Year	# Seed Requests	# Seedlots
1983	85	772
1984	86	807
1985	123	1 603
1986	156	1 329
1987	156	865
1988	123	761
1989	98	615
1990	119	807
1991	102	893
1992	93	765
1993	91	810
1994	102	778
1995	53	440
1996	17	99
1997	52	742
1998	64	617
1999	58	488
Average	93	776

During 1999, a total of 58 seed requests representing 488 seedlots were processed. Most of the requests were from Canada but seed was also sent to the China, Estonia, France, the Philippines, Russia, and the United States. It is interesting to note that the number of seedlots sent to China is almost as high as what was sent within Canada (Table 7).

Table 7. Number of requests and number of seedlots shipped by country in 1999.

Country	# Requests	# Seedlots
Canada	47	224
China	5	219
Estonia	1	6
France	1	4
Philippines	1	21
Russia	1	2
United States	2	12
Total	58	488

SEED TESTING

Germination tests are performed on all freshly collected seedlots as well as seedlots in storage that have not been tested for several years. In most cases, due to small seedlot size, four replicates of 50 seed are placed on moistened Kimpak in germination boxes. When larger seed is being tested, the number of seed is reduced. Two replicates of 100 seeds are sometimes used especially when dealing with small seed. **Nine hundred germination tests** were carried out in 1999.

Table 8 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 the operations of 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 seedlot has been cleaned, the percentage of moisture is determined by oven-drying a weighed sample of seed at 103-105 °C for 16 hours. The target moisture content for orthodox seed is between 6 and 8 percent. Seed that are above this range are further dried before being stored. **Three hundred and eighty moisture content determinations** were carried out by NTSC staff in 1999.

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 is then calculated. A total of **three hundred and thirty-one 1000-seed weights** were done in 1999.

Table 8. Number of germination (Germ.) tests, moisture content (MC) tests, and 1000-seed weight (TSW) tests, carried out between 1983 and 1999.

Year	# Germ.	# MC	# TSW
1983	961	1 400	992
1984	1 079	132	686
1985	2 101	744	1 758
1986	1 349	266	1 259
1987	691	73	91
1988	658	275	377
1989	517	627	543
1990	431	713	303
1991	323	176	139
1992	413	126	336
1993	793	218	708
*1994**	*0*	*0*	*0*
*1995**	*13*	*14*	*13*
*1996**	*0*	*13*	*16*
1997	702	143	425
1998	964	319	710
1999	900	380	331
Average	842	399	618

* *The figures for these years are not included in the calculation of averages.*

Red Oak Storage Experiment

Lori Burry, an undergraduate student in forestry at the University of New Brunswick, completed her thesis on storage of red oak (*Quercus rubra*) acorns. Oak is considered to be a recalcitrant species when it comes to storage. This means that acorns cannot be dried; rather their moisture content must be maintained in order to maximize viability. Storage for more than six months is not usually a concern for nurseries but is necessary for seed banks.

Acorns were collected from three trees at one week intervals for three weeks. Acorns were stored at 4°C in glass jars and invigoration tubes with and without peat. The glass jars were 1 litre Mason jars while the invigoration tubes were pieces of 10 cm diameter PVC pipe 30 cm long. Gortex was used to cover both ends of the invigoration tubes and the mouth of the jars. Enough acorns were stored to permit sampling every 6 months for 24 months.

Moisture content and germination of the acorns declined over time with the greatest decrease for the acorns stored in the invigoration tubes. Tables 9a and 9b show results for acorns stored in glass jars after 12 months of storage.

Table 9a. Germination (Germ) and moisture content (MC) (%) of red oak (*Quercus rubra*)acorns stored in glass jars without peat after 0, 6, and 12 months.

	0 months	6 months	12 months
Germ.		87.0	54.8
MC	39.2	39.3	34.6

Table 9b. Germination (Germ) and moisture content (MC) (%) of red oak (*Quercus rubra*) acorns stored in glass jars with peat after 0, 6, and 12 months.

	0 months	6 months	12 months
Germ.		100	48.4
MC	39.2	46.6	42.3
MC peat	73.4	34.7	38.5

Moisture content of acorns stored with peat was higher probably because they absorbed moisture from the peat as seen by the decline in moisture content of the peat. Germination showed a decline from 6 to 12 months for both storage treatments.

Differences in germination of acorns collected from the three trees diminished with time but collection date effects were persistent implying that acorns must be mature before collection commences.

Willow Storage Experiment (1998)

In 1998 a willow storage experiment using willow seed was started to examine the possibility of long-term storage. Willow was selected since there are three species in Canada that are rated "Special Concern" and very little is known about long-term storage of the species.

Collections of pussy willow *(Salix discolor)* and Bebb willow *(Salix bebbiana)* catkins were made at the UNB woodlot in Fredericton on May 20th and June 2nd, 1998, respectively. The catkins were brought into the lab and left to air dry until they were fully opened. The "cotton" containing the seed was then rubbed on a screen to dislodge the seed. Moisture content, 1000-seed weight, and germination tests were performed on the seed prior to storage. Seed was stored at ambient, 4°C, and -20°C. Germination tests were performed at intervals to determine the seed quality (Tables 10a and 10b).

Table 10a. Germination (%) of *S. discolor* seed stored at 20°C, 4°C, and -20°C.

Week #	20°C	4°C	-20°C
1	96.0	96.0	96.0
3	79.0	83.5	88.5
4	55.0	72.0	87.0
6	31.0	72.0	85.5
26	0.0	6.5	76.5
52	0.0	0.0	78.5

Table 10b. Germination (%) of *S. bebbiana* see stored at 20°C, 4°C, and -20°C.

Week #	20°C	4°C	-20°C
1	99.0	99.0	99.0
2	77.0	90.5	94.0
4	39.0	79.0	85.0
26	0.0	78.0	86.5
52	0.0	53.5	80.0

Seed stored at ambient temperature (20°C) lost viability very quickly and all viability was lost within 7 weeks for *S. bebbiana* and 9 weeks for *S. discolor*. Seed stored at 4°C performed better but also decreased in viability. Seed stored at - 20°C performed best and germination percentages of 78.5 and 80.0 were observed 12 months after storage.

The *S. discolor* was infested with aphids. These were impossible to completely remove from the sample. The stored sample contained many aphid parts. The effect this had on the seed is not known. Moisture content of the *S. bebbiana* and *S. discolor* were 8.9 and 9.1 % respectively. This moisture content is higher than what is considered optimal for most seed.

Willow Storage Experiment (1999)

Based on the encouraging results of the 1998 willow storage experiment, a follow-up experiment was initiated in 1999. Three willow species: Bebb willow (*Salix bebbiana*), pussy willow (*Salix discolor*), and red topped willow (*Salix eriocephala*) were collected in late May - early June, 1999. The seed was extracted within 3 days of collection, the samples were cleaned and the moisture contents determined. The fresh seed was tested at its original moisture content. Two replicates of 100 seeds each were germinated and the following results were obtained: *S. bebbiana* (89.0%), *S. discolor* (60.5%), and *S. eriocephala* (71.5%). The collections from each species were halved and one of the sub-samples dried to a lower moisture content. The seeds were placed in cryogenic vials and stored at four different temperatures (4°C, -20°C, -80°C, and -196°C). The seed will be tested at 3, 6, and 12 months and at 2, 3, 4, and 5 years. The results of the first 2 test periods can be found in Tables 11a, 11b, and 11c.

Although the seed have only been tested twice since they were stored, some interesting observations can be made. The first and probably most important observation is that willow seed can be successfully stored at extremely low temperatures (-80°C and -196°C) without any significant detrimental effects. Another interesting point is that moisture content does not appear to be critical in the storage of willow seed. In fact, the seed stored at the higher moisture contents appears to be doing better than those stored at lower moisture contents. The differences in germination percentages among the various storage conditions has not manifested itself yet. It is expected that the seed stored at 4°C will deteriorate over time. There was a slight loss in the germination percentages for all three species at 6 months compared with the results obtained after 3 months storage.

Table 11a. Germination (%) of *S. bebbiana* stored at 4°C, -20°C, -80°C and -196°C and at moisture contents of 8.61% and 7.17%.

Test Period	4°C		-20°C		-80°C		-196°C	
	8.61	7.17	8.61	7.17	8.61	7.17	8.61	7.17
3 months	87.00	88.50	82.50	89.50	89.50	84.00	93.00	87.50
6 months	84.50	84.00	89.25	82.75	89.50	85.50	85.75	82.50

Table 11b. Germination (%) of *S. discolor* stored at 4°C, -20°C, -80°C, and -196°C and at moisture contents of 9.76% and 5.08%.

Test Period	4°C		-20°C		-80°C		-196°C	
	9.76	5.08	9.76	5.08	9.76	5.08	9.76	5.08
3 months	54.50	72.50	59.50	72.00	75.50	56.00	68.50	63.50
6 months	55.50	56.00	69.50	48.00	69.00	57.75	68.00	63.00

Table 11c. Germination (%) of *S. eriocephala* stored at 4°C, -20°C, -80°C, and -196°C and at moisture contents of 8.51% and 7.31%.

Test Period	4°C		-20°C		-80°C		-196°C	
	8.51	7.31	8.51	7.31	8.51	7.31	8.51	7.31
3 months	59.00	76.50	62.00	71.50	71.50	61.50	63.00	55.00
6 months	53.75	50.75	71.25	46.50	65.75	52.25	59.75	48.25

Sugar Maple Germination Experiment

Six sugar maple (*Acer saccharum*) seedlots were selected for the test. Each seedlot was tested using the traditional method of 8 weeks stratification at 4°C followed by 4 weeks in the germinator set at 20°C for 16 hours (dark) and 30°C for 8 hours (light). A parallel test was also carried out using the same seedlots but with the pericarp removed. Germination results ranged from 3 - 39 % (mean of 12 %) for the sample that had the pericarp intact (Table 12). The results for the samples with the pericarp removed ranged from 1 - 41 % (mean of 15 %). The samples with the pericarp removed were moldy which may have reduced germination. A follow-up test using longer stratification periods may yield better results.

Table12. Germination (%) of sugar maple (*Acer saccharum*) seed with pericarp intact and pericarp removed.

Seedlot #	Pericarp intact		Pericarp removed	
	HV[1](%)	LV[2](%)	HV[1](%)	LV[2](%)
9810043.0	3	6	1	7
9810048.0	7	4	20	1
9810058.0	3	0	4	1
9810060.0	15	4	15	5
9810066.0	4	0	10	8
9810070.0	39	4	41	5

[1] High Vigor
[2] Low Vigor

White Spruce Germination Experiment

Thirty-three white spruce (*Picea glauca*) seedlots that were stored under different conditions were tested after 15 years in storage. These seedlots were all single-tree collections from the range-wide white spruce provenance tests established in cooperation with PNFI in the early 1980s. The seedlots selected for the test were all from Whitney, Ontario and collected in 1984.

When the seed was originally collected, it was distributed to various organizations. The Tree Breeding collection seems to have been the main collection. These seed were stored in glass jars at 4°C. Sub-samples of approximately 50 grams each were transferred to the Seed Bank and stored in glass jars at -20°C. An additional 10 grams from each collection was placed into small plastic packages and placed into larger jars and also stored at -20°C.

The quality of storage for the seed stored at 4°C is uncertain. Many of the jars had mold on the outside and some of the seed had a musty smell. The Seed Bank seed remained in frozen storage but may have been taken out periodically or occasionally for testing or to fill seed orders. The seed stored in the small plastic packages were kept in frozen storage and not removed unless absolutely necessary.

Four replicates of 50 seed each were placed on moistened Kimpak and stratified for 3 weeks at 4°C and then placed in the germinator for 3 weeks. The germination conditions were 20°C for 16 hours dark followed by 30°C for 8 hours light.

The Provenance Test seed stored in the 10 gram packages and placed in larger jars and stored at -20°C performed best with an average germination of 96.8 %. The Seed Bank seed stored in glass jars at -20°C had an average germination rate of 87.1 %. The poorest germination was obtained from the Tree Breeding seed stored at 4°C. The germination rate for these seed was only 49.9 %. The results of the test for each seedlot can be found in Table 13.

Table 13. Comparison in germination (%) after 15 years storage of white spruce seedlots stored at the NTSC.

Seedlot #	Seed Bank (-20°C)	Tree Breeding (4°C)	Provenance Test (-20°C)
8431300	94.5	85.0	94.0
8431370	97.5	54.0	100.0
8431390	97.5	8.0	98.0
8431400	89.5	4.0	96.0
8431410	63.5	22.0	98.0
8431420	63.0	25.0	96.0
8431430	97.5	32.0	98.0
8431440	96.0	0.0	98.0
8431450	67.5	78.5	78.0
8431460	70.5	2.0	94.0
8431470	93.5	44.0	96.0
8431480	94.0	69.0	98.0
8431490	99.0	78.0	94.0
8431510	32.0	58.0	98.0
8431520	94.0	23.0	100.0
8431530	86.0	32.0	98.0
8431540	94.0	54.0	98.0
8431550	98.5	10.0	98.0
8431560	91.0	6.0	100.0
8431570	36.0	0.0	90.0
8431580	96.0	92.0	100.0
8431600	96.0	15.5	96.0
8431610	90.5	88.0	98.0
8431620	87.5	76.0	94.0
8431630	95.0	90.0	96.0
8431640	93.0	97.0	92.0
8431660	98.0	77.0	98.0
8431670	83.0	71.0	90.0
8431680	93.5	86.0	92.0
8431700	98.0	80.0	96.0
8431710	99.0	97.0	96.0
8431720	97.5	56.0	92.0
8431730	96.0	36.0	100.0

Northern Red Ash Germination Experiment

A single northern red ash seedlot (*Fraxinus pensylvanica* var. *austini*) was subjected to 7 different stratification treatments (0, 4, 8, 12, 16, 20, and 24 weeks). Following stratification, the seed was placed in a germinator set at 20°C for 16 hours dark and 30°C for 8 hour light. The seed remained in the germinator until germination activity had ceased.

Northern red ash does not have the same degree of dormancy as white ash (*Fraxinus americana*). Hence some germination occurred even without stratification. However, germination improved with stratification until about 20 weeks. Since only a single fresh seedlot was used in the experiment, it is difficult to draw any conclusions and further testing should be carried out to establish the best method.

Bur Oak Storage Experiment

Bur oak (*Quercus macrocarpa*) acorns were collected at Jemseg, New Brunswick on September 11, 1997. The acorns were floated in water and all "sinkers" surface dried and placed in zip-lock plastic bags in a cooler at 4°C. Moisture content was carried out on September 22-24 and calculated to be 49.67%. Four hundred and sixty-four acorns were placed in germination boxes on October 23 and stored in a cooler at 4°C to control moisture loss. Acorns were placed in a single layer on the grate in the germination boxes. Moisture content was carried out on November 5 (44 %) and again on November 19 (36 %). By this time, the endosperm had visibly shrunken and pulled away from the pericarp.

The storage experiment was initiated on November 20, 1997. Samples of seventy-five acorns each were placed in invigoration tubes (13" long, 2.5" inside diameter PVC pipe) and covered at both ends with 3-ply Gortex held in place with pipe clamps. The experiment was comprised of two treatments: treatment 1 contained acorns only, while treatment 2 was a mixture of acorns and peat (original moisture content of peat was 74%). The volume of acorns in both treatments was approximately 300 ml. The treatment containing the peat had an additional 300 ml of peat. The moisture content and germination of the acorns were determined at 26, 52, and 78 weeks.

The acorns stored with peat had a higher germination than those stored without and the moisture content was higher, likely due to the absorption of moisture from the peat (Table 14).

Table 14. Moisture content (MC %) and germination (Germ. %) of bur oak acorns after 26, 52, and 78 weeks storage.

Treatment	With Peat		Without Peat	
	MC	Germ.	MC	Germ.
26 weeks	40.9	45.0	31.6	8.0
52 weeks	NA	33.0	NA	5.0
78 weeks	42.5	13.0	28.5	5.0

VISITORS TO THE SEED CENTRE

Each year, numerous people tour the Seed Centre. Most are researchers and forestry workers from Canadian provincial and federal governments, academia and industry. Several foreign visitors also tour our facility. Following are the names of some of the visitors in 1999.

In January, Mr. Dave Kolotelo of the BC ministry of Forests visited the Seed Centre. He was in New Brunswick for a nursery workshop which was organized by Ron Hallett.

The Seed Centre was used as a lab for a class from the University of New Brunswick. A fifth year Nursery Practices class, toured the Seed Centre and were introduced to seed germination techniques.

Mr. W. J. Oudemans, a director of the Schlovenhorst Arboretum in the Netherlands visited the Seed Centre. Mr. Oudemans is a resident of Stanley, New Brunswick. The Oudemans family has been involved with the arboretum for over one hundred years. The Schlovenhorst Arboretum had received seed from the National Tree Seed Centre when it was located in Petawawa. He was interested in visiting our facility and shared some very interesting information about the arboretum. The Schlovenhorst Arboretum was founded in 1848 by Dr. J. H. Schober. It currently extends over 180 hectares. The arboretum is open to the public and contains tree collections and plantations with a special emphasis on scientific and educational activities.

Ms. Eleonora Kuripko, a scientist with the Yeltsin Democratic Fellowship Program visited the Seed Centre in April. She brought back some red oak seed for planting trials in Russia.

Two Japanese scientists; Mitsue Fukie and Hamako Sasamota, also visited the Seed Centre in April. Ms. Fukie works in a gene expression laboratory while Mr. Sasamota's work has to do with cell manipulation.

Dr. Allison Dibble of the USDA Forest Service toured the Seed Centre. She is an associate professor at the University of Maine. She has worked with various *Amelanchier* species as well as birch hybrids.

In June, Bruce Pendrel and Michel Bourque brought the CFS Human Resources managers for a visit of the Seed Centre.

In September, Bruce Pendrel and Dr. Taumey Mahendrappa hosted a delegation from the Jilin Academy of Forest Sciences (JAFS), Jilin province, China. Ms. Shen Xiaohui, is the Associate Professor and the Vice Director of Soils Laboratory for the province of Jilin, and Mr. Gao Chang Qi is a Professor, and the Deputy Director of JAFS. The objective of their visit was to promote research work of mutual benefit to both our countries. As a result of this collaboration, we received a request for seed from Mr. Shang Qi.

EQUIPMENT CHANGES / MODIFICATIONS

Ventilation Fan

In 1998, the Seed Centre requested that air quality checks be made in the Lab in order to determine the extent of airborne particles. The tests indicated that although base levels of airborne particles were low, the numbers rose drastically when seed processing was taking place. This was especially evident in the cone processing room where the cones are tumbled. The levels of dust and especially fungal spores was identified as a potential health concern.

The result of these tests was that a more powerful ventilation fan be installed to draw these airborne particles out of the lab. The fan has been installed and should greatly improve the air quality of the lab. Special thanks to Joe McEachern, Don Ringuette, and Mark Nickerson for making this possible.

Poplar and Willow Processing

The method used in the past for processing the seed of poplar and willow was slow and inefficient. The problem with these species is that the seed is contained inside catkins. The catkins must be opened and the seed separated from the "cotton". In the past, the method used was to allow the catkins to open naturally and then rub the "cotton"containing the seed through a metal screen to dislodge the seed. There were several disadvantages to this method. Poplar and willow seed tend to deteriorate very quickly after they are shed. Therefore, it is imperative that the seed be processed as soon as possible after collection. Also, the seed were being forced through the screen and this increased the risk of physical damage to the seed. Finally, rubbing the cotton tented to matt everything into a ball and many of the seed became trapped and impossible to separate.

A process was developed in 1999 that greatly improved the efficiency of extracting the seeds. A screen "wrap" was fabricated using wire mesh. This wrap was attached to the cone tumbler so that the seed could pass though while keeping the catkins and the "cotton" inside. The system was tried but the turning of the drum was not sufficient to dislodge the seed. A Shop Vac was hooked up so that it would blow the air out. This worked well but we still has the problem that some of the catkins were not opening. We then attached a hot air source (hair dryer) to the Shop Vac hose and this worked extremely well.

Freezer Space

Nineteen ninety-eight was the third year since the NTSC moved to Fredericton. The space available for frozen storage (-20°C) was found to be insufficient. It was therefore decided to convert one of the coolers from 4°C to -20°C. The shelving was removed and replaced with sliding track shelving. This increased our shelf storage space by over 2.5 times. There is also the opportunity to further increase this by adding additional shelving or by decreasing the space between shelves. This provided sufficient space to separate the Seed Bank, Tree Breeding, and Reserved seedlots collections. Another improvement to the storage area was the labeling of all of the storage bins with laminated labels. This makes finding and replacing seedlots much easier and faster.

NATIONAL TREE SEED CENTRE STAFF

The staff at the NTSC in 1999 consisted of one full-time seed technologist (Bernard Daigle) and a fourth-year forestry student (Daniel Knox) who was hired for one day/week from January-March, 13 weeks in the summer and one day / week from September - November. The staff is under the supervision of the National Forest Genetics Resources Centre manager, Mr. Dale Simpson.