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CANADIAN TREE IMPROVEMENT ASSOCIATION/  
ASSOCIATION CANADIENNE POUR L'AMÉLIORATION DES ARBRES



*Tree Seed Working Group*

## NEWS BULLETIN

No. 29, November 1998

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### A WORD FROM THE CHAIRMAN

Well, it is November 17<sup>th</sup> and I am running about a month and a half behind schedule. Editor Ron wanted to have our fall edition of the Working Group News Bulletin out no later than November, so here we go.

Staff at the Tree Breeding Centre anticipated a busy spring and summer and we weren't disappointed. Our breeding program was compressed into about 10 days due to an early season and ideal weather conditions for this work. The next project turned out to be a control program for white-marked tussock moth in our selection plantations and poly-cross tests using back-pack mistblowers, in all we treated just under 25,000 trees in this method.

As we expected, the harvesting of cones from our orchards proved to be a formidable task. But everyone got into the act and not only did we manage to collect all available cones and almost within budget. We did however, have to recruit secretaries, clerks, technicians, and foresters from other DNR offices to help harvest the crop before the cones released their seed. Of note, we collected over 100 hectoliters of black spruce cones, 31 hectoliters of white pine, and 84 hectolitres of Norway spruce cones from our orchards. We did not collect white or red spruce due to large quantities of seed already in storage.

I was recently asked about the type of seed research we are currently involved with? We are not presently working on any seed related research programs, our clients whether they be the provincial nursery or private growers have not expressed any need to study the seed we are providing or selling. So we have gone on the premise that if it's not broken then don't fix it.

Seed work currently stands at the routine standard tests required for storage and sowing rate determination. Perhaps this is a reflection of the high quality service provided at the Atlantic Forest Tree Seed Centre in Fredericton where most of our seed is extracted.

The only new development in this province which might be worth mentioning is the establishment of an industrial research chair program in the Dept. of Biology at Dalhousie University. This chair will lead a program in genomics, population genetics and molecular breeding of forest trees.

So until next time, I would like to wish everyone a Merry Christmas and Best of Luck in the New Year.

**Howard Frame**

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### EDITORS NOTES

#### **Tree Seed Research: Is anyone doing any?**

It does not seem that long ago that the federal forestry service (currently Natural Resources Canada, Canadian Forest Service) supported active forest tree seed research programs in several of the federal labs, most notably at the Pacific lab in Victoria, B.C. and at the Petawawa National Forestry Institute (PNFI) in Chalk River, Ont. Our esteemed colleagues, George Edwards at Pacific and Ben Wang at PNFI, were true champions of these programs. However, following the retirements of George and Ben, seed research programs within CFS were no more - But have they really gone the way of the dodo?



In the late 70's and early 80's, planting programs were expanding and fledgling tree improvement programs were being established throughout much of the country. The emphasis was definitely on what could be termed traditional 'intensive' forest management. Significant CFS resources were directed at seed research designed to support these tree improvement and nursery programs. In the 1990's the forestry pendulum has swung towards selective harvesting, concerns about biodiversity, multiple-use management, etc. Although 'Seed Research Programs' are no longer identified as separate research entities within CFS (with the possible exception of the National Forest Genetics Resources Centre/Forest Tree Seed Centre), there are a considerable number of projects involving work with forest tree seeds. These could be considered as being among the kept secrets around! A quick perusal of the 1997-1998 study plans for the five federal forestry labs revealed over 12 studies/projects directly involving various aspects of seed-related research. This research falls under the aegis of four different networks: Biodiversity, Biotechnology and Advanced Genetics, Forest Health, and Pest Management Methods. I would suggest that this somewhat more disjointed effort with respect to forest tree seed research has diminished the perceived importance that these programs actually have. Similarly, I strongly suspect that seed research is similarly camouflaged in university and government labs - although we do need to acknowledge the active program at the B.C. Ministry of Forests.

Perhaps it is time to examine forest research programs in an effort to compile much of the new information that is being produced. Is this a possible role for the Tree Seed Working Group or even perhaps a potential theme for our next workshop. I would welcome any comments/thoughts or ideas on this matter.

### **Are you Reading This?**

As with most voluntary publications, soliciting contributions is not always a lot of fun. However, to be fair, in the relatively short time since inheriting the role of editor of the NewsBulletin from Hugh Schooley, I have received quite a few articles, news tidbits, etc, from across the country and there are a few regular contributors to whom I am greatly appreciative. None-the-less, I want

to take the opportunity at this time to ask that you seriously consider submitting a brief note/article.

The next tree Seed NewsBulletin is scheduled for May 1999. This winter would be a good time to put pen to paper (fingers to keyboard) and prepare a short contribution. For those who may not be familiar with this newsletter, the rules are simple - there are no rules! (or at least practically none). Short to medium length articles reporting on results from basic or operational trials (including preliminary results), general news or information, problem discussions, comings and goings of colleagues, book reviews, etc. are all welcome. The intent here is to promote communication among the many of us who are doing work in the area of tree seeds, but due to limitations imposed by being scattered across the country, have a hard time keeping abreast of what recent developments have taken place outside of our local area.

Please send your ideas/contributions to me by March 31, 1999 (preferably before). The summer of 1998 was an excellent year for cones, seeds, and nuts for many species. Why don't you let your colleagues know what experiences, problems, etc. you had.

I would hope that, with your help, we could stop tree seed research from being, as I mentioned earlier, one of the best kept secrets around.

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### **Seed Trivia - Did you know?**

The seed coat in many tree species have membranous protrusions called "wings" that enhance the wind dispersal of mature seeds. In some species the wings may be easily detached: wings of pine seeds are attached by hygroscopic "hydrosnappy" hooks which spread apart when wet. Spruce seeds sit in a depression of the wing, much like the bowl of a spoon, while in fir, a flap of the wing is partially wrapped around the seed.

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Comments, suggestions and contributions for the Newsletter are welcomed by the Chairman or editor.



### Stratification in Germination Dishes

The BC Ministry of Forests Tree Seed Centre (TSC) has historically stratified tree seed in vials. Each replicate of 100 seeds was soaked in a separate vial, drained of all water and surface dried before placing the seed back into the vial. The vial was then placed into a cooler at 2-5°C for the prescribed stratification duration, then transferred to germination dishes for testing. This was a labour intensive method and it was suggested that we stratify the seeds directly into germination dishes and minimize the amount of seed handling required.

Seeds have been stratified in germination dishes at the Pacific Forestry Centre (PFC) since 1970 and both methods are described in 'Methods and procedures for testing tree seeds in Canada' (Edwards 1987). At PFC they have placed the dry seed on filter paper and Kimpack into the germination dish with a prescribed amount of water (50 ml). Since we always soak seed before sowing, except western redcedar which is pelleted, we continue to soak seed in vials. Before switching methods we decided to perform some double testing to determine if differences exist between these two types of stratification and testing. Differences between the methods are illustrated in Table 1 showing how stratification in dishes removes the need to surface dry the seed and place and remove the seed from the vial.

**Table 1.** Differences in methodology between stratifying tree seed in vials or in dishes.

Vial stratification	Dish Stratification
soak seed	soak seed
drain seed	drain seed
remove seeds from vial	remove seeds from vial
surface dry seed	
place seed into vial / stratify	
remove seed from vial	
Place seed into dish	Place seed into dish / stratify

A total of 39 seedlots from eight different species were tested with both methods. The stratification in the vial produced slightly better germination (87.0%) compared to the seed stratified in dishes (85.4%). An advantage of stratifying seed in dishes is the reduction in fungal buildup. This was confirmed with five Douglas-fir seedlots which showed an average *Fusarium* sp. infection of 9.1% of the seeds when stratified in dishes and 15.5% when stratified in vials. If dishes do become overrun with fungi prior to germination testing the germination media will be replaced. On average, stratifying in dishes saves about 3 minutes per germination dish or about 12 minutes per germination test by removing the surface drying as well as placing and removing each replicate of seed from a vial. The reduced seed handling will diminish the probability of errors occurring when handling seed. The TSC is now stratifying all seedlots of Douglas-fir, lodgepole

pine, spruce, mountain and western hemlock, and western larch in dishes. The slight decrease in germination is more than compensated for by the reduction in seed handling and pathogen infection and the increased efficiency over past methods.

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#### Formation of a New Seed Group - The International Society for Seed Science

The following excerpts were taken from the SEED BIOLOGY internet discussion group and should be of interest to tree seed researchers.

Fellow Seminologists:

The response to my suggestion that an international society for seed science should be formed was very positive, even enthusiastic. I pointed out that the society could build on the already existing International Workshops, other meetings and the seed net set up by Ralph Obendorf.

Since asking for your views I have been talking with several colleagues and I now have a number of persons who would be willing to serve as officers of the society, in the first instance, and have accepted nomination. It is intended that the new Society will be inaugurated at the 6<sup>th</sup> International Workshop on Seed Biology in Merida, Mexico, in January 1999 (see Upcoming Meetings).

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#### Cryoconservation of Seeds

The following message was taken from the SEED-BIOLOGY Discussion Group. Perhaps some of our readers might be able to assist in this request.

I am scientific fellow at Botanical Institute RAS (St.-Petersburg, Russia) currently undertaking germination studies on plant seeds (except horticultural) frozen in liquid nitrogen. I need any information concerning the cryoconservation of seeds, germination ecology of these seeds and further development of seedlings. Contacts of scientists who undertaking the same studies will be equally appreciated.

Thanks in advance,  
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#### Upcoming Meetings

**VI International Workshop on Seed Biology**  
**January 24-28, 1999**  
**Merida Yucatan, Mexico.**

For information contact:  
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**TheThird International Workshop on Desiccation-  
sensitivity And -Tolerance In Seeds And  
Vegetative Plant Tissues**

January 3rd to 15th , 2000  
South Africa.

To facilitate reservation of a venue and costing of the meeting, we need to know - as soon as possible - about your intention to participate. For those who have not yet responded to the first announcement, we'd appreciate your indication of interest to the following email address:

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**Book Review**

**Seeds: Ecology, Biogeography, and Evolution  
of Dormancy and Germination**

by Jerry Baskin and Carol Baskin

ISBN: 0-12-080260-0  
Academic Press, 1998

Seeds: Ecology, Biogeography, and Evolution of Dormancy and Germination differs from all other books on seed germination. It is an all-encompassing volume that provides a working hypothesis of the ecological and environmental conditions under which various kinds of seed dormancy have developed. It also presents information on the seed germination of more than 3500 species of trees, shrubs, vines and herbaceous species, making this a valuable reference for anyone studying germination.

This book delivers information on characteristics of each type of seed dormancy, how each type of dormancy is broken in nature, and what environmental conditions are required for germination after dormancy is broken. It explains how studies should be done to distinguish persistent from transient seed banks, and covers which species should be controlled, propagated, and conserved. "Seeds" gives the reader insight and guidelines for doing ecologically meaningful studies on the biogeography and evolution of

seed dormancy and germination in order to better understand plant reproductive strategies, life history traits, adaptations to habitats, and physiological processes.

Please let me know if you need any further information.

Thank you.

Sincerely,  
Dee Dee Tscherch  
Promotions Manager  
Marketing Department, Academic Press

**Germinating Fraser Fir Seed**

Fraser Fir has become an item of interest and I thought that the following trial information should be shared as it would provide some food for thought to all who involved with this species or other low germinating seedlots . The project was carried out at Western Tree Seeds Ltd in Blind Bay, BC. during the winter of 1997 for Weyerhaeuser Company, Washington.

As germination was relatively low we wanted investigate the potential and response to a variety of upgrading procedures and find which offered the best gains that would be satisfactory to the user. Five different trial sets were devised giving us the following results, a control accounts for an additional trial test. The control was used to verify the initial seedlot germination as received and also included as trial regime.

**Seedlot Background Information:**

922.200 grams received  
Purity: 98.1%,  
Moisture Content: 5.96%,  
1000 SWT.: 9.040 gm  
Original Germination: 57%

**Testing Method:**

6 trial regimes;  
All seed was given a 24 hr. aerated soak in water at 25.2° C. prior to stratification for 30 days;  
4 reps X 100 seed per test;  
seed moisture content was 22.9% when stratification was begun.

### Germination after 7 weeks:

- |   |       |
|---|-------|
| 1) Control - seed as received                                 | 50.5% |
| 2) Clean seed by aspirating;<br>good fraction (= 257.176 gms) | 63.5% |
| " after cleaning purity 99.6%"                                |       |
| removed fraction (= 570.000 gms)                              | 42.5% |
| assessment fraction (= 95.024 gms)                            |       |
- 3) Using 50 gms of seed from the good fraction, seed was sized into three sizes;
- |        |        |
|--------|--------|
| small  | 71.25% |
| medium | 73.50% |
| large  | 72.50% |
- 4) Using 50 gms of seed from the good fraction, seed was separated by aspiration, into three density fractions after the initial soaking treatment.
- |   |        |
|---|--------|
| A | 66.25% |
| B | 78.50% |
| C | 73.75% |
- 5) Using 25 gms of seed from the good fraction, seed was subjected to prevac at two different pressures
- |                              |        |
|------------------------------|--------|
| - up to 20 inches of mercury | 58.50% |
| - up to 25 inches of mercury | 67.00% |
- 6) Using 25 gms of seed from the good fraction, seed was initially treated with a H<sub>2</sub>O<sub>2</sub> rinse, 10% solution for 74.00%, 25 mins., prior to the 24 hr. aerated soak

I think that the conclusions can be best drawn by the reader of this article and trust that it has provided a scope that approaches a creative way of investigating the upgrading possibilities not only for this particular seedlot but for other seedlots where low germination presents a concern.

The project work was jointly developed and completed by Diane Riley; Tom Hilman; Mishtu Banerjee; Kim Creasey.

If anyone is interested in more details please feel free to contact Kim Creasey - Nature's Common Elements - (705)835-1521/(705)739-8463



### Germination Dish Moisture Level: Germination Effects

Several conifer species show a higher than usual incidence of abnormal germinants in our laboratory: western redcedar (Cw), western hemlock (Hw) and western larch (Lw). All three species are considered challenging to process and both Cw and Hw have resin vesicles in their seed coat making them susceptible to damage. A small investigative trial of germination dish moisture level was initiated based on the following observations in slash pine *"Extremely low moisture levels inhibited radicle initiation and hypocotyl elongation while extreme high moisture levels appeared to stunt only root growth"* (Belcher 1975). The objective of this trial was to determine to what extent germination dish moisture level affects germination capacity (GC) and percentage of abnormal germinants (AB). This trial tested two seedlots of each species at three moisture levels: 25 ml, 50 ml [our current standard] and 75 ml. The seedlots chosen had large numbers of abnormal germinants in recent germination retests. Each species was tested with its standard germination testing procedure except for the amount of moisture in the germination dish.

The results indicate that on average the current procedure of adding 50 ml to germination dishes produces the highest GC and the greatest number of seeds germinating [GC + AB] (Table 1). The seedlots of Hw and Lw were not greatly influenced by less moisture, but practical GC reductions (12%) and increases in abnormal seedlings (2%) were observed with 75 ml of water. Falldowns in GC with increased moisture content may be due to species differences in sensitivity to moisture levels (Belcher 1975), increases in seed mold (Belcher & Perkins 1985), or decreases in megagametophyte reserves through increased respiration rates (Leadem 1993). It has also been shown that 'weak' seeds have more specific moisture requirements for germination than 'strong' seeds (Belcher & Perkins 1985).

Some seedlots (Hw 4537 and Lw 31608) show large increases in abnormal germinants with 75 ml of water. Seedlot 4537 is the oldest seedlot in

this trial (1978), while 31608 is the youngest (1991) so it does not appear that increased abnormal germinants are due to seedlot age. Abnormal germinants were of two types: **reversed embryos** that are "predetermined" prior to germination and **stunted radicles** that could be the result of mechanical damage,

environmental conditions or pathogens. The identification of stunted radicles is subjective and in seedlots showing a high incidence of these abnormal germinants one wonders if the same morphology and proportion would appear in the nursery environment?

Table 1. The germination capacity % (GC) and % abnormal germinants (AB) of seedlots tested with 25, 50 and 75 ml of moisture in germination dishes.

Sp.	Seedlot	25 - GC	25 - AB	50 - GC	50 - AB	75 - GC	75 - AB
Cw	33264	61	11	69	12	67	10
Cw	5012	37	15	43	15	42	14
Hw	4677	54	10	56	11	56	13
Hw	4537	85	4	82	6	64	22
Lw	5080	43	5	40	6	19	10
Lw	31608	91	2	90	2	83	8
	MEAN	62	8	63	9	55	11

In Cw, the 25 ml treatment appeared detrimental to GC and this is probably because dry testing is employed for Cw, requiring the seeds to imbibe moisture from the media, while the other two species are already imbibed and stratified prior to testing. The Cw seeds are not imbibed prior to testing as they are operationally pelleted 'dry' for all nurseries in BC. Both seedlots at all moisture levels produced ten or more (10%+) abnormal germinants which I consider extremely high. These abnormalities are generally stunted radicles (>90%) and the subjectivity in determining stunted radicles, in particular, may introduce an additional source of variability in Cw testing.

It appears that species which are imbibed and then tested react negatively to high moisture levels, but low moisture levels do not appear to impact germination. In dry tested species the low moisture level negatively impacted germination by restricting water uptake, but high moisture levels did not reduce germination or increase the incidence of abnormal germinants. A problem that requires additional work is how will germinants classified as abnormal perform in the nursery. Differences in relative humidity, temperature and moisture regimes may enable some of these germinants classified as abnormal under test conditions to produce normal seedlings in the nursery. If anyone has additional

information on this topic or would like to correspond on it, please contact me.

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## National Tree Seed Centre

In my article in the May issue I projected there would be a heavy seed crop this year. Well, for once, I was right! There was a good crop on all tree and shrub species. We were extremely active in collecting seed. In the end, over 300 collections were made from about 50 species. The majority of these collections were bulks comprised of seed from 20-40 trees, when possible and practical, from a location. Seed was collected from a number of species not listed in the current catalogue: *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry), *Betula cordifolia* (mountain paper birch), *Betula x caerulea* (blueleaf birch), *Cephalanthus occidentalis* (button bush), (*Corylus cornuta*) beaked hazel, *Juglans cinerea* (butternut), *Quercus macrocarpa* (bur oak), (*Salix bebbiana*) Bebb willow and (*Salix discolor*) pussy willow. Collection is often the easy part; trying to get the seed to germinate is the real challenge.

I mentioned that encouraging seed to germinate can be a challenge but long-term storage is another area to be dealt with. As noted above, seed was collected from two species of willow this spring. An *ad hoc* storage experiment was established whereby seed of each species was stored at room temperature, +4° C, and -20° C. As might be expected, seed at room temperature did not last long; about two weeks. However, seed in the cooler and freezer yielded up to 85% germination after 5 months with the seed stored at -20° C showing the best performance. Seed will be monitored periodically until the supply is exhausted. In the case of willow it is particularly important to be able to store seed long-term because there is at least one willow species in Canada which are classified as "threatened." The winter months will be spent processing and germination testing the seed collected this year. As well, germination testing of seed already in storage will be ongoing.

An undergraduate forestry student at UNB started a red oak seed storage experiment last year for her thesis. She will be analyzing data from two sampling times; 6 and 12 months after storage. The experiment was designed for a 24 month duration. Another undergraduate forestry student is working with white ash for his thesis. He is investigating several methods for determining germination and viability.

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## Progress in Seed Research: Conference Proceedings

Dear Seed Biology Colleagues:

Looking for that perfect holiday gift for that special seed biologist (or maybe yourself), then purchase a copy of 'Progress in Seed Research: Conference Proceedings of the Second International Conference on Seed Science and Technology. The proceedings are papers from a conference held in Guangzhou, China in 1997. Progress in Seed Research is a soft cover publication with 348 pages. The number of papers by heading is as follows:

Seed dormancy, germination and development (13)  
Desiccation tolerance in seeds (7)  
Seed storage and Germplasm conservation (13)  
Seed quality and Enhancements (10)  
Somatic embryogenesis and Biotechnology (5)

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## Publication Available

### Proceedings of the Forest Seed Collection, Treatment and Storage Workshop.

This publication contains articles dealing with all aspects of forest tree seeds from around the world. Copies can be obtained at a cost of \$5.00 for shipping and handling from:

Forest and Game management Institute  
Res. Stn. Uherské Hradiště  
686 04 Kunovice  
Czech Republic  
Tel: 420-632/549-115  
Fax: 420-632/549-119  
Email: vulhmvs@brn.pvtnet.cz



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