Tree Improvement Branch

Cone and Seed Improvement Program
BCMoF Tree Seed Centre

From Seed and Seedling Extension Topics
Volume 6 June 1993

Yellow Cypress Stratification Trial

Yellow cypress (*Chamaecyparis nootkatensis* (D.Don) Spach) [Yc] is a valued tree species where it grows, with the highest stumpage value of our B.C. conifers [$10.49/ m^3]. The reforestation effort for this species is currently restricted to the Vancouver forest region and accounts for about 360 000 trees being planted annually (Miller, 1992). There are currently 23 seedlots [5 from seed orchards] of yellow cypress available for reforestation. The average germination of YC is the lowest of our B.C conifers at 34 %. Vegetative propagation of this species is an attractive alternative, but due to the presence of three cypress seed orchards and the hesitation some foresters have with clonal forestry the need for improvement of Yc germination is critical to reforestation of this species. The reasons for such poor performance in germination include:

⇒ the need for two full growing seasons following pollination for seeds to mature in B.C. [maturity in one-year is possible in seed orchards] which provides a large window for pest or environmental degradation of the embryos [the average yield/cone is only 2 seeds (Owens & Molder, 1984)].
⇒ one and two-year-old cones may occur on the same branch - this will result in immature seeds being included in the collection - these are thought to be fairly easily removed during processing.
⇒ low temperatures at time of pollination may cause abortion or arrested development of the ovules or young cones (Owens and Molder, 1984).
Þ feeding on the overwintering pollen cones by a mite (*Trisetacus chamaecypari)* can result in the destruction of up to 60% of the pollen cone crop (Colangeli, 1991).
⇒ that 'considerable variability in stage of embryo development at seed shed exists in all stands' (Colangeli, 1991).
⇒ the species is thought to have compound dormancy consisting of embryo dormancy (need for moist chilling) and also a seed coat impermeability problem where water is restricted from entering the seed.

Cypress is currently tested and pretreated using a 48 hour running water soak - 1 month warm [≈ 20°C] conditioning followed by - 2 months stratification [≈2°C]. This trial was designed to look at other treatments (T) which may produce better germination in a comparable amount of time [3 months]. Six seedlots (9539, 14659, 32454, 32879, 35130 and 35134) were selected and the following treatments were applied

TREAT.	SOAK	WARM	COLD
1	48 hours	28 days	60 days
2	until seed sinks	28 days	60 days
3	until seed sinks	28 days + IS*	60 days
4	until seed sinks	IS*	60 days
5	14 days	28 days + IS*	60 days
6	28 days	28 days + IS*	60 days

*IS refers to interrupted stratification where the seeds in cold stratification were placed in room conditions [≈20°] for 8 hours once a week during the cold stratification period.

The use of extended soaks (14 & 28 days) was based on the promising results that were obtained with this treatment by Forestry Canada (unpublished data) and the Tree Seed Centre [TSC] (unpublished data). In both cases the 28-day soak provided the best results. From these results and observations of others it is now generally considered that high moisture is critical to any Yc treatment and "drowning" of seeds is highly unlikely as seeds have been observed to germinate immersed in water. As a guideline to when enough moisture has been imbibed many use the simple criteria that when the seed sinks it has imbibed adequate moisture. Variability will exist within any seedlot for imbibition, but it is felt that no damage, due to lack of aeration, will occur to Yc seeds that sink quickly within a seedlot. Both Industry and the Ministry of Forests have used interrupted stratification, although there does not appear to be any reference or justification for its use in the literature and therefore its effectiveness, compared to other treatments should be investigated.

For each treatment 400 seeds were used (4 replicates X 100 seeds) and placed in a CONVIRON germinator set at 30°C for 8 hours with fluorescent lighting and at 20°C for 16 hours in the darkness [5 of the 36 combinations used 50 seed replicates due to a shortage of seed]. Germination counts were performed Monday, Wednesday and Friday over 28 days to obtain estimates on germination capacity (GC) and germination rate. The results for the various treatments averaged over all 6 seedlots are presented in Figure 1 for GC. The treatments 1A and 2A represent the results of remaining seed from treatments one and two (5 of the 6 seedlots) which had an additional 30 days of stratification. The sample sizes for these results are smaller due to limited quantities of seed, but averaged 254 seeds compared to 400 seeds for the regular treatments.

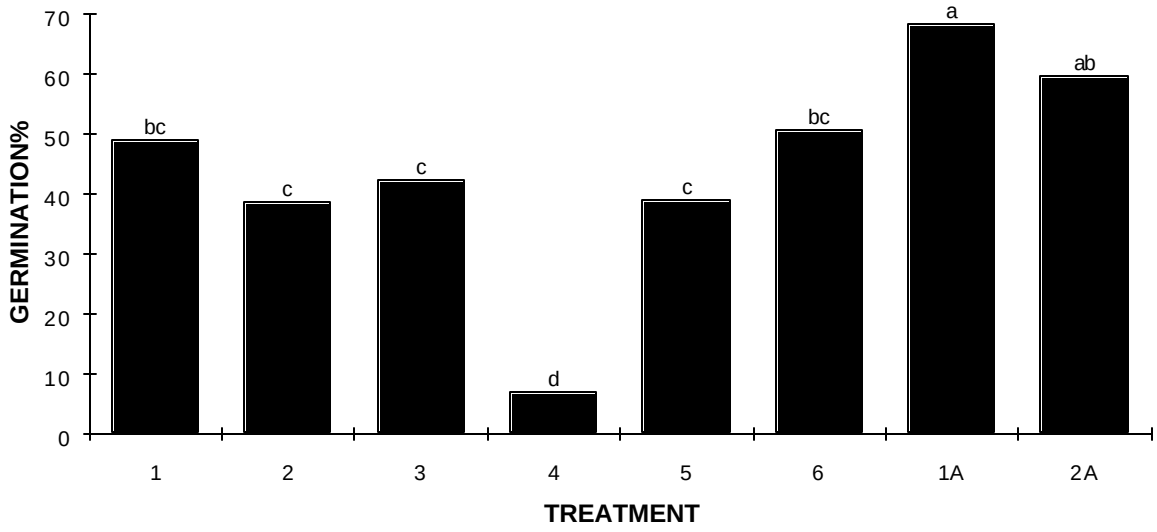

Figure 1. Results of the pretreatments on germination capacity for yellow cypress [treatments with the same letter are not significantly different at $\propto$=0.05]..

In looking at the results for GC the most obvious result is that the **interrupted stratification is a poor substitute for warm conditioning** (T3 vs. T4). The removal of warm preconditioning accounted for an average decrease in germination of 35 % and is the only treatment of the original six which is significantly different ($\propto$ = 0.05). This result agrees with work performed by the

USDA in Juneau, Alaska on varying duration's of warm/cold stratification where no warm stratification resulted in almost total failure of the seedlot to germinate. The best germination was obtained with 60 days warm and 90 days cold stratification (USDA, unpublished results).

The effect of interrupted stratification in conjunction with warm conditioning (T2 vs. T3) resulted in a modest average increase of 3.7% in GC. The best response, of the original six treatments, was to soak the seeds for 28 days that resulted in a small (1.7%) increase over the control. In earlier trials at the TSC comparison of these treatments, with 10 YC seedlots, yielded n increase in germination of 13.4% with the 28 day soak. The discrepancy between these two trials remains unanswered and although the 28 day soak results in higher germination the additional month required may not make it a viable option for production purposes given the relatively low level of improvement found in this trial.

The smaller samples that received the extra month of stratification [1A and 2A] produced the best results. The additional month increased the germination of treatment 1 by 19.2% and treatment 2 by 21.1%. In comparing these results to the longer soak times it appears to me that **the additional month is more efficiently used for prolonging the stratification period rather than introducing a 28 day soak.** For the future preparation of yellow cypress the following are considered critical:

- The insurance of adequate moisture into the seed and the maintenance of high moisture content throughout pretreatment.
- The extension of the cold stratification period in order to break the dormancy of as many seeds as possible.

The question of extending the stratification period is basically a problem of logistics - getting the seedling requests into SPAR in time to meet the sowing date with an extended pretreatment. Yellow cypress requires 12 weeks of pretreatment and approximately a 2 week administrative and withdrawal timeline for a total of 14 weeks after the request is approved. The addition of one month to stratification will bring the total to 18 weeks. Therefore, the early planning and requesting of sowing requests allows for flexibility and enhancement of germination by providing a larger window for extending the stratification period. Sowing requests can be approved through SPAR after July 1 of the year prior to sowing and it is recommended that for the growing of yellow cypress that the use of the additional one month of cold stratification be used whenever possible. In terms of future work with yellow cypress it is of interest to know the optimal stratification period and this will be addressed in future work on this species. More details on this current trial, related to rate of germination and variability between seedlots, can be obtained by contacting David Kolotelo, Cone and Seed Improvement Officer, TSC ,at 574-0461.

References

Colangeli, A. 1991. Reproductive Biology - pollen/seed/seed orchards. *In* Yellow Cypress: Can We Grow It? Can We Sell It? Proceedings of a Symposium March 26-28, 1990. Richmond, B.C. pp.29-30.

Czabator, F.J. 1962. Germination Value: An index combining speed and completeness of germination. Forest Science 8:386-396.

Miller, D. 1991. Annual Report of the Ministry of Forests for the fiscal year ended March 31, 1991. 79 pp.

Owens, J.N. and M. Molder. 1984. The reproductive cycles of western redcedar and yellow-cedar. Ministry of Forests. 28 pp.

David Kolotelo, RPF, **Cone and Seed Improvement Officer**
Dave.Kolotelo@gems7.gov.bc.ca **(604) 541-1683 extension 228**