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Response of Interior Spruce to Extended Stratification

The germination response of 26 interior spruce (the complex of *Picea glauca* (Moench) Voss, *Picea engelmannii* Parry ex Engelm and their hybrids) seedlots to three treatments: soaking, soaking plus three weeks stratification and soaking plus six weeks stratification was investigated. Chris Hawkins evaluated the same seedlots for various seedling attributes at Red Rock Research Station. The first year nursery results for these seedlots were presented at the 1993 Forest Nursery Association of British Columbia meeting in Courtney, B.C. (in press).

For white spruce there are many references showing that three weeks stratification overcomes embryo dormancy (Caron et al. 1993; Edwards 1980; Leadem 1993; Santon 1970; Wang 1976). Investigations by Santon (1970) showed that 4 weeks of stratification was preferable to 3 weeks. Leadem showed optimal germination at between 3 and 6 weeks stratification, but this was dependent on the temperature regime used for testing. The use of 12 weeks stratification resulted in lower germination compared to three and six weeks stratification at all three temperature regimes (Leadem 1993). This study was initiated to complement work performed by Chris Hawkins and provide information on the benefits of extending stratification in interior spruce.

Materials and Methods

The 26 seedlots for this trial were comprised of 20 wild stand collections and six seed orchard collections. A total of 600 seeds were available for each seedlot. The selected treatments were a 24 hour soak; a 24 hour soak plus three weeks stratification (moist chilling of seed - moisture content approximately 30% and temperature 2°C); and a 24 hour soak plus six weeks stratification. For each treatment 200 seeds were available per seedlot and these were allocated to four replications of 50 seeds. Each replication consisted of a germination dish with Kimpack, blotting paper and 50 ml of water added. Treatments were scheduled so that all germination dishes could be placed into the testing environment at the same time. The testing was conducted in a Conviron germinator with a 30°C regime with light for eight hours alternating with a 16 hour regime at 20°C in darkness. Seeds were evaluated for 21 days and considered germinated when the radicle reached a length of 4X the length of the seed coat. Abnormal germinants were not included as germinated seeds. The level of dormancy was quantified as the germination percent of the three week stratification treatment divided by the germination percent of the soak treatment. This parameter indicates the relative degree of dormancy for use in comparing seedlots.

Results and Discussion

The total germination [germination capacity] of seedlots did not, on average, increase with an increase in stratification from three to six weeks (Figure 1). Both treatments resulted in a total germination of 88%. The embryo dormancy present in these seedlots was apparently overcome with the standard regime of three weeks stratification. Differences in germination were greatest at

day seven when the soak treatment had a germination level of only 51%, while the three and six weeks stratification gave germination capacities of 73% and 77% respectively.

The response to extended stratification varied among seedlots sampled. Some seedlots such as 25578 showed large gains by extending stratification, but five seedlots performed more poorly with extended stratification (Table 1). The soak only treatment generally showed good results indicating that dormancy was not 'deep' in this sample of interior spruce seedlots. The dormancy as presented was relatively uniform between seedlots ranging from 1 to 15%. It is unclear why some seedlots perform better with only a soak treatment, but possible explanations could be the presence of fungal pathogens or mechanical damage. A standing water soak was used in this trial to avoid cross contamination among the 26 seedlots, but use of a running water soak may have lessened any impact pathogens may have had with extended stratification.

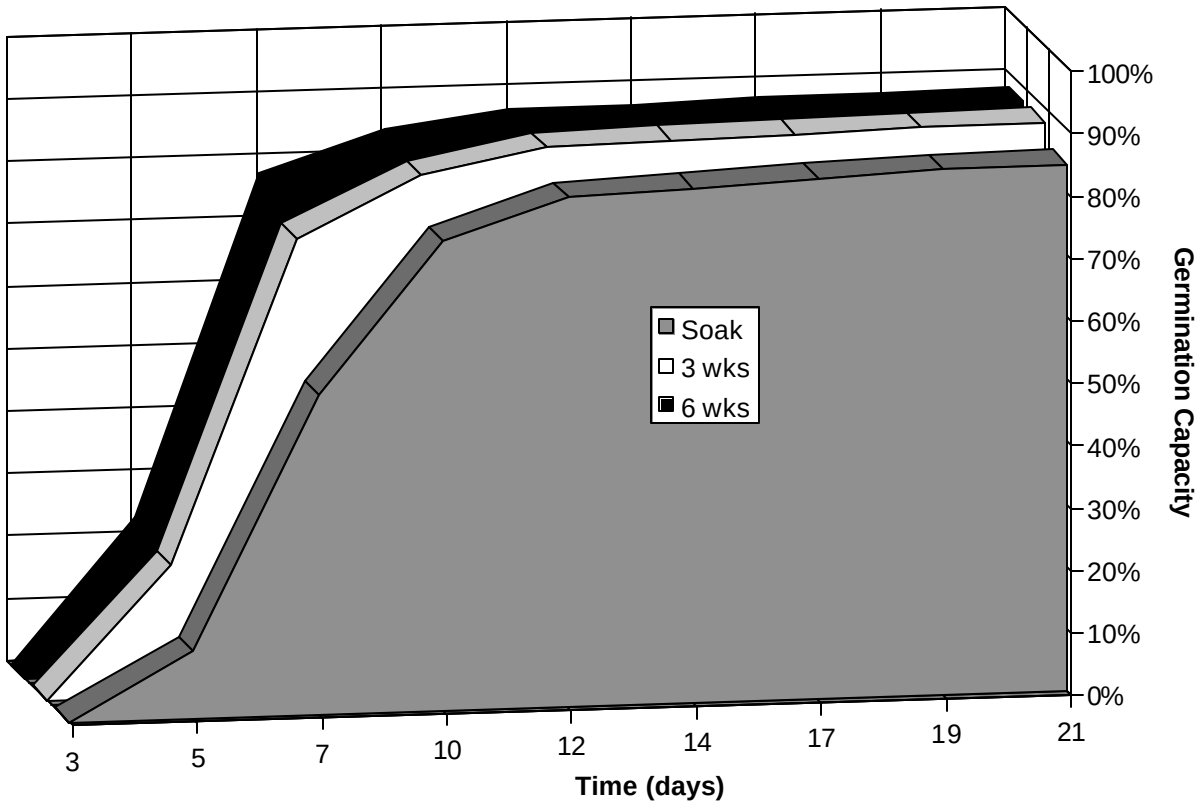

Figure 1. The response of 26 interior spruce seedlots to a 24 hour soak [soak], a 24 hour soak plus 3 weeks stratification [3 wks], and a 24 hour soak plus 6 weeks stratification [6 wks].

There were no differences found between the responses of seed orchard and wild stand seedlots to increases in stratification. There was some concern that since orchard seed is collected closer to natural seed dispersal that the seeds may exhibit deeper dormancy and require longer stratification. This was not supported by the results, however much fewer seed orchard seedlots (22%) than wild stand seedlots were included in the sample.

Although gains in germination capacity were not great by extending stratification, the rate of germination increased in 23 of the 27 seedlots by extending stratification to six weeks. These

differences are not large (Figure 1), but crop uniformity will increase and the time period available for fungi to establish themselves as pathogens on succulent tissues will decrease. Increased duration's of stratification have been shown to widen the range of temperatures over which germination will occur (Gosling & Rigg, 1990). If maintenance of high germination temperatures is problematic extended stratification will allow the seeds to germinate at lower temperatures! Stratification will also reduce the need for light during germination (Edwards & Olsen 1973; Wang 1987) and reduce performance differences between seedlots which have received different collection, handling and storage techniques *[within reasonable limits]* (Wang 1987).

The standard treatment supplied by the Tree Seed Centre (TSC) is to stratify interior spruce seedlots for 21 days following a 24 hour soak. Following the three weeks stratification the seed will then be kept in stratification until the shipping date. The shipping date is determined to maximize the efficiency of shipping sowing requests to nurseries and usually results in an additional week of stratification. After arrival at the nursery the seed will be kept in cool conditions further extending the stratification period. The actual stratification duration that a sowing request obtains will be a combination of the standard three week pretreatment plus the time until shipping from the TSC plus the time spent at the nursery until sowing and it is not uncommon for this total stratification period to approach six weeks. The extension of stratification at the TSC does not seem necessary for interior spruce due to the small gains obtained and the normal extension of stratification occurring at the TSC and the nurseries. If anyone is interested in extending stratification in interior spruce one can simply move the sowing date forward [allowing seed to sit in stratification at the nursery longer]. If you are interested in extending stratification for other species please contact myself for available information on your species of interest.

Literature Cited

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Table 1. The Germination Capacity (GC) of 26 seedlots with a 24 hour soak [soak]; 24 hour soak plus 3 weeks stratification [3 weeks]; and 24 hour soak plus 6 weeks stratification [6 weeks] and a quantification of dormancy based on the results of 3 weeks stratification divided by the soak treatment..

Seedlot	GC% - soak	GC% - 3 weeks	GC% - 6 weeks	Dormancy
2666	69	70	74	1.01
4073	68	75	76	1.10
4932	84	89	85	1.06
6675[1]*	93	96	95	1.03
6863*	86	92	96	1.07
6866*	95	90	96	0.95
6913*	93	99	94	1.06
6914*	95	94	94	0.99
6915*	92	94	94	1.02
8139	89	87	95	0.98
8565	68	78	71	1.15
8582	87	92	81	1.06
8779	84	82	82	0.98
8782	90	92	90	1.02
8791	69	71	65	1.03
8976	81	86	77	1.06
14501	85	89	90	1.05
25578	54	62	73	1.15
29164	77	85	88	1.10
29170	87	88	90	1.01
30543	95	90	97	0.95
30664	94	96	96	1.02
31117	86	96	92	1.12
31308	94	96	96	1.02
31460	90	95	93	1.06
35075	94	97	96	1.03

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[1]* seed orchard produced seedlot