



Cone and Seed Improvement Program BCMoF Tree Seed Centre



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Tree Seed Centre Quality Assurance (QA) Program

This article reviews part of the Tree Seed Centre Quality Assurance program that is dedicated to ensuring quality seed for reforestation.

Moisture Content and Germination Falldowns

Estimates of stratification moisture content and germination falldowns have traditionally been an output of our QA program (see <http://www.for.gov.bc.ca/hti/treeseedcentre/tsc/csio3-sowingrequestsh.htm>). This year we are combining the five-year estimates for these assessments into one table and providing a more comprehensive comparison between A (orchard-produced) and B (natural stand) seed, including the statistical significance (t-test, two-way, $\alpha = 0.05$) of the difference between these variables for A-class and B-class seed.. The Table also presents results of lab testing, QA sampling prior to shipping, and feedback from nurseries on the actual nursery germination (see Table 1).

Table 1 .Five Year Averages (2003-2007) for Stratification Moisture Content, Germination Capacity (GC) and Germination Falldowns [samples sizes in brackets]. Shaded cells represent **statistically significant * differences between A and B class seed.**

Species	Genetic Class	Lab		Seed Preparation		Nursery	
		Moisture Content % [n]	GC % [n]	GC % [n]	GC % Falldown [n]	GC % [n]	GC % Falldown [n]
Ba	B	33.6 [13]	73.1 [16]	78.0 [16]	4.9 [16]	74.9 [8]	-3.1 [8]
Bg	B	33.5 [18]	77.6 [19]	78.7 [19]	1.1 [19]	71.6 [13]	-4.1 [13]
Bl	B	37.3 [52]	65.4 [56]	64.8 [56]	-0.6 [56]	58.0 [29]	-10.5 [29]
Cw	A	NA - pelleted	85.5 [89]	82.3 [85]	-3.6 [85]	80.1 [58]	-5.1 [58]
Cw	B	NA - pelleted	79.5 [94]	76.7 [91]	-2.4 [91]	77.5 [66]	-3.2 [66]
DR	B	NA - pelleted	70.3 [19]	67.7 [19]	-2.6 [19]	65.1 [14]	-7.6 [14]
Fdc	A	32.2 [60]	93.0 [74]	92.9 [59]	0.1 [59]	92.4 [53]	-1.2 [53]
Fdc	B	32.7 [34]	88.1 [35]	89.5 [35]	1.3 [35]	84.7 [21]	-1.1 [21]
Fdi	A	32.2 [14] *	93.0 [16]	94.7 [13]	1.5 [13]	80.0 [9]	-3.4 [8]
Fdi	B	34.1 [81]	88.4 [85]	91.1 [82]	2.3 [82]	87.8 [74]	-0.2 [74]
Hm	B	33.6 [20]	83.1 [20]	88.0 [20]	4.9 [20]	79.3 [19]	-5.0 [19]
Hw	A	26.2 [38] *	89.9 [41]	89.4 [41]	-0.5 [41]	87.8 [33]	-2.6 [33] *
Hw	B	29.1 [31]	82.3 [32]	83.7 [32]	1.4 [32]	84.7 [29]	3.3 [29]
Lw	A	34.2 [36] *	90.0 [37]	90.0 [37]	0.0 [37]	89.9 [30]	-0.1 [30]
Lw	B	35.5 [50]	83.4 [51]	86.0 [51]	2.6 [51]	83.9 [44]	0.3 [44]
Plc	B	28.3 [17]	94.0 [17]	93.8 [17]	-0.2 [17]	91.8 [9]	-0.7 [9]
Pli	A	29.5 [43]	96.4 [55]	95.3 [43]	-1.1 [43]	93.8 [39]	-2.7 [39]
Pli	B	30.1 [94]	94.0 [115]	93.4 [93]	-0.3 [93]	92.0 [87]	-1.3 [86]
Pw	A	36.8 [107]	91.4 [95]	85.8 [88]	-5.5 [88] *	85.5 [79]	-5.6 [78] *
Pw	B	37.1 [13]	81.8 [12]	69.6 [11]	-11.4 [11]	67.0 [10]	-14.8 [10]
Py	B	27.5 [55]	90.4 [57]	87.8 [56]	-2.5 [56]	88.8 [35]	-2.0 [35]

Sb	B	32.4 [8]	72.8 [8]	72.0 [8]	-0.8 [8]	75.8 [7]	3.2 [7]
SS	A	22.3 [12] *	96.6 [12]	92.3 [12]	-4.3 [12] *	91.6 [9]	-4.8 [9]
SS	B	27.2 [30]	91.1 [31]	91.2 [31]	0.2 [31]	90.1 [25]	-1.5 [25]
Sx	A	26.5 [78] *	92.0 [94]	94.1 [80]	2.5 [80]	92.1 [74]	0.2 [74]
Sx	B	31.3 [53]	85.3 [55]	86.4 [54]	1.1 [54]	84.5 [46]	-0.2 [46]
SxS	B	30.2 [24]	87.0 [24]	89.2 [24]	2.2 [24]	84.9 [17]	-3.2 [17]
Yc	B	44.8 [7]	50.3 [7]	58.0 [7]	7.7 [7]	76.0 [3]	23.7 [3]
Total Sample Sizes		988	1266	1170	1170	940	937

Table 1 provides an indication of average stratification moisture content [mc] by species and genetic class. Significant genetic class differences for mc are observed in Fdi, Hw, Lw, Ss and Sx, but only in Hw is there also a significant difference in germination at the nursery. These mc differences have been observed for several years and are an indication that differences due to the genetic material or production site exist, but generally these differences have little or no impact on seed quality or seedling production. These mc differences may simply be a result of the larger seeds we see from Pinaceae seed orchards. Growers should pay extra attention to small sowing requests of species exhibiting relatively low moisture contents (Hw and SS in particular) to ensure that these seeds do not dry out during the sowing phase.

Falldowns in seed preparation and at the nursery are quantified relative to the latest lab germination (a negative number is a decrease relative to lab germination). The largest seed preparation falldowns are with Pw and A-class SS. At the nursery large (>5% difference) falldowns were experienced with Pw, Bl, Dr, A-class Cw and Hm. Note for Pw that greater falldowns are being experienced with B-class seed and it appears that our stratification protocols are optimized to overcoming dormancy in our seed orchard crops which account for over 95% of the Pw sown over the past five years.

Thank you to all nurseries for providing data for this assessment. Your contributions greatly assist us in quantifying lab tests with actual nursery results and identifying testing priorities.

Pelleted Species

Pelleting (covering seed with a coating for ease of handling and use in sowing equipment) is performed on all redcedra (Cw) requests and most red alder (DR) seedlots. In addition to our germination testing, we perform assessment on the efficiency of pelleting. The variable estimated is the proportion of pellets displaying one seed per pellet. The test is based on eight replicates of 25 seeds and each pellet is dissolved and classed as having one seed/pellet, empty, containing debris, or having more than one seed per pellet. See Table 2 for testing results over the past five years.

Table 2. The results of the pelleting assessment 2003-2007. Figures indicate the percentage of pellets with one seed per pellet with sample sizes in brackets.

Species	2007	2006	2005	2004	2003
Cw	99.0 [30]	98.7 [35]	96.9 [33]	98.0 [26]	96.0 [24]
DR	97.9 [4]	95.9 [5]	93.7 [6]		

Test results indicate very high efficiencies for the pelleting process. We have had virtually no complaints on pellet quality over the past two years and Carl Happel, the contractor who performs this service, is commended for his efforts and diligence.

Returned Seed

Returned seed was again used operationally in 2007 and we requested nursery feedback on the germination of all returned seed sowing requests. We received nursery (Nurs) feedback on 84% (64/76) of these requests providing a good indication of the operational performance of this type of seed at the nursery. The returned seed program, for 2007, involved only the following species in the following seedlot proportions: Pli (53%); Sx (20%); Fdc (20%); Fdi (4%); Cw (3%); and SS (1%). Table 3 presents the

returned seed (QAR) results separately for A-class (62000 series) and B-class (52000 series) seedlots in comparison to regular seedlots (QA) of the same species (sample sizes enclosed in brackets).

Table 3. A comparison between sowing requests ((QA-SRQ) and returned seed (QAR-SRQ) sowing requests in terms of Lab germination capacity (GC), QA GC at shipping, and GC at the nursery (Nurs) with falldowns indicated relative to the lab germination.

	Lab GC (#)	QA GC (#)	QA Falldown	Nurs GC (#)	Nurs Falldown
QA- SRQ	89.2 (110)	89.8 (97)	0.3 (97)	85.2 (90)	-2.5 (89)
QAR – SRQ - A	94.2 (47)	94.3 (7)	-0.4 (7)	93.2 (41)	-1.3 (41)
QAR – SRQ - B	93.5 (29)	95.2 (5)	-0.2 (5)	92.8 (23)	-0.1 (23)

The nursery falldowns on the seed are quite small at -1.3 for returned orchard seed and -0.1 for returned natural stand seed. The nursery results have a lot of 'background noise' (e.g. extended stratification, upgrading, sanitation treatments etc..) that is beyond our control, so I am not concerned about the difference between -1.3 and -0.1, but very pleased that the results were generally quite good for returned seed. The Nursery falldown for our primary QA-SRQ program is slightly larger and I think the best explanation is that we "generally" only attempt to re-use seedlots that perform well, but in our primary QA-SRQ activities there is more of an emphasis of sampling the range of seedlots being used, especially those that may exhibit problems. Our QA program is continuing to evolve and we appreciate any feedback you may have.

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