Tree
Improvement
Branch

Cone and Seed Improvement Program
BCMoF Tree Seed Centre

from Tree Seed Working Group Newsbulletin #50 Dec 2009 AND TicTalk #10 Sept 2010

How Can Seed Tests Help Valuate Seeds?

This article will provide an overview on how the results of seed tests can help in the valuation of tree seeds. It is intended to provide both the seed owner and the seed buyer with a better understanding of their product. The discussion provided will be general in nature, but examples will be provided in reference to the current BC Ministry of Forests seed prices:
http://www.for.gov.bc.ca/HTI/treeseedcentre/tsc/fees.htm#surplus
and in the context of our seed use legislation in BC (Chief Foresters Standards for Seed Use):
http://www.for.gov.bc.ca/code/cfstandards/html/

The most common and simplest valuation system is to sell seeds on a standard price per Kilogram and the various adjustments to this based on seed testing results will be discussed.
The importance of seedlot moisture content for longevity of orthodox seed is rarely questioned and even though most people recognize that seed weight is influenced by moisture content, this variable seems absent from seed valuations. Our legislation states that for registration the moisture content [MC] must be between 4 and 9.9%, yet if we sell by seed weight the difference in moisture content is not accounted for. Does this really matter? Let's use Sitka spruce ($4000/kg) as an example. If a kilogram of seed was at 4% MC then the dry weight equivalent is 960 grams *vs.* 901 grams at 9.9 % mc. So, one kg can vary by as much as 59 grams of dry mass and for Sitka spruce this difference is equivalent to about $236/Kg. The difference reaches its peak with western redcedar where the acceptable moisture content range can result in a $384/Kg difference.

It is generally accepted that reduced moisture content will increase seed longevity, so the intent is certainly not to advocate moisture loading to increase the cost recovery of seed sales. It is simply one of the seedlot characteristics that varies and can easily be incorporated into pricing. Moisture content also contributes to differences in seed yield when presented as Kg of seed per Hl of cones and a similar correction factor to those discussed can also be employed to standardize yield reporting.

The results of seed weight and purity tests will be discussed together as they both influence the number of seeds per gram which is a variable we use in BC to calculate potential seedlings. The purity of a seedlot is simply the average proportion of a seedlot deemed to consist of pure seed. A purity of 99.0% implies that 990 grams out of one Kg of seed will be pure seed and the remaining ten grams will consist of debris (inclusion of seeds of other species is quite rare, but also considered an impurity if applicable). The seed weight test is the average weight of 100 seeds (derived as the average of eight replicates) and is a method of quantifying seed mass.

To provide a more meaningful seed mass variable, seeds per gram [SPG] is used and calculated as the seedlot purity (%) divided by the average weight of 100 seeds. The higher SPG values represent the lightest seeds and vice versa. This is probably the largest and most important source of variation unaccounted for in seed valuation. I'll supply a few examples: for seed orchard produced coastal Douglas-fir, the SPG ranges from 106 to 68 indicating that there is a difference of 38 seeds available per gram or 38 000 seeds per kilogram. For natural stand lodgepole pine, the range is much greater (504 to 253) resulting in a difference of 251 000 seeds per kilogram! These examples illustrate the extremes for effect, but clearly show that attention to SPG can result in a much lower (or higher), but more realistic cost per seed compared to a standard price per Kg. Certainly one consideration is whether there is a practical advantage in the use of larger seeds. I am not convinced that an advantage exists in terms of plantation success, but there are contradictory results in the literature. A good review is provided by Sorenson and Campbell (1985) and some additional comments are provided by Kolotelo (2000). An alternate view, along with different references, is provided by Castro et al (2008). If you believe that seed size is an important attribute to meet your objectives then you may be content paying more per seed based on a simple, unadjusted per kilogram cost.

Germination Capacity (GC) is the variable that has been used in seed valuation in BC. Currently, if a seedlot is below the species average then a price adjustment is applied using the specific seedlot germination as a proportion of the species average germination [seedlot GC / species GC]. No cost adjustment is applied to above average germinating seedlots. The GC is the other variable along with SPG that is used in the calculation of potential seedlings and that may be a variable used to valuate seed. A simpler solution may be to use the GC and SPG variables independent of the relationship to potential seedlings. This could take the form of quantifying the **germinable seeds** represented as **(amount of seed [g]) X (SPG) X (GC/100)**. Instead of a basic seed price per Kg of seed, this more encompassing variable would have seed pricing as a function of germinable seeds. A further refinement could be to account for the seedlot moisture content (as a decimal value in the equation) in terms of germinable seeds on an oven-dry (0%) or other standardized (i.e. 7%) moisture content. For oven-dry weight assessment the equation would expand to:

Germinable seeds based on dry weight = **(amount of seed [g]) X (1-MC) X (SPG) X (GC/100)**

This variable is intended to account for variability in seed attributes between seedlots. I believe the greatest benefit would be derived by integrating GC and SPG as these are the most variable results between seedlots. There is also variability within a seedlot and this has been quantified as the precision of germination tests and can be surprisingly high in some cases. Variability in SPG tests within a seedlot has not been similarly quantified, but as is common with our relatively wild tree species – variability should be the expectation.

In addition to the standard tests of seed characteristics, other variables may also aid in seed valuation. Fungal assay testing is one example, but valuation is complicated because the link between fungal occurrence (% contamination or infection) does not readily correspond to disease or loss of seedlings, but a quantification of potential risk. A seedlot with 10% Fusarium contamination has greater risk than a 2% seedlot, but the relationship may not equate to five times the risk. These relationships have not been well documented and unique nursery conditions could play the largest role in the risk of seedling loss.

Other variables such as Genetic Worth for growth or disease resistance may play an important role in seed valuation, but these values are not the product of a seed testing lab. There are several seed testing results that may improve the quantification of seed value to more closely reflect the number of germinable seeds and adjust for differences in moisture content. Hopefully, this will promote further discussion on seed valuation and a better appreciation of how seed test results practically impact the commodity value of each unique seedlot.

References

Castro, J., P.B. Reich, A. Sanchez-Miranda and J.D. Guerrero. 2008. Evidence thatthe negative relationship between seed mass and relative growth rate is not physiological but linked to species identity: a within-family analysis of Scots pine. Tree Physiology 28:1077-1082.

Kolotelo, D. 2000. Differences in seed and seedling attributes between select (orchard produced) and standard (wild stand) seedlots. In Proc. 20th Forest Nursery Association of BC Annual Meeting. Tech. Co-ord. N. Wilder, P. Byman and C. Hawkins. Sept. 18-21, 200. Prince George BC

Sorenson, F.C. and R.K. Campbell. 1985. Effect of seed weight on height growth of Douglas-fir (*Pseudotsuga menziesii*) seedlings in a nursery. Can. J. For. Res. 28:418-426.

David Kolotelo, RPF
Cone and Seed Improvement Officer
Dave.Kolotelo@gov.bc.ca
(604) 541-1683 extension 2228