

## CONE HANDLING SYSTEM FROM FIELD TO PROCESSOR

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Seed procurement as a part-time, once every 3 years ordeal is coming to an end, especially for newly expanded operations in the northwest intermountain area. Quite often the specifications for quality seed are totally in the hands of the field personnel, after which the final cone storage and extraction work is the total responsibility of a nursery staff or private seed company. To get high quality seed from field to processor, both field and nursery people must put together a well-planned cone collection system. Any breakdown in the system will affect the seed quality, the seedling quality, and the cost.

How much can be paid for high quality seed? Using a seed cost of \$5.00/M seedlings produced for a greenhouse container crop, the following chart shows the seed value as percent germination decreases:

Seed values/pound for Douglas-fir container nursery

% germination	Seeds/cavity	Seeds/pound (D.f.)		
		25 M	35 M	45 M
95+	1	\$125.00	\$175.00	\$225.00
75	3	41.67	58.33	75.00
50	6	20.83	29.17	37.50

From the 50% to the 95+% germination seed, the seed value increases six times. Actual growing costs associated with the lower germination potential seed are considerably higher than the single sown 95+% seed because the increased seed volume means higher stratification, sowing, and thinning costs. Additional savings for 95+% seed could be as much as \$5-20/M in container nurseries. The 95+% germination seed also reduces grower risk from additional failures caused by fungus and low vigor seedlings resulting from poor quality seed.

To get seed with 90+% germination rates is defined in one word: control. The late Charlie Brown of Brown's Seed Company in Vancouver, Washington, presented his Control Items at cone collection seminars. Here are Charlie Brown's items for "control", which Potlatch Corporation has put into action to collect high quality seed:

- 1. Early crop analysis in the field.** As early as mid-June, the crop potential of cone numbers can be evaluated. As a general rule in North Idaho: the lower the number of cones, the lower the seed quality. With accurate 5-year to 10-year plans of seed needs, collections should occur only on heavy seed-yield years.

An elementary but important fact to remember is that collection costs and extraction costs are rather fixed; the amount and quality of seed recovered is the major variable. So, unless seed inventories are critically low, only moderate to heavy crops should be collected to avoid higher costs and lower percent germination lots.

2. **Adequate pre-planning to locate and set up needed collection areas.** By utilizing 5 and 10-year plans, actual areas can be selected for future cone harvest. This could involve excluding areas from logging until cones are harvested. Other areas may be set aside indefinitely for cone collection activities.
3. **Type of cone collection.** The type of cone collection--climb and pick, fall trees, and pick or squirrel cache--will have an effect on seed quality. Squirrel cache collections should be avoided because it is impossible to consistently get 90+% germination from squirrel cut cones. This is due to two factors:
  - a. Squirrel cache collections are characterized by inconsistent maturity levels and large variations in dormancy, resulting in lower and extended germination.
  - b. Squirrel cache collections have the high probability that cones and resulting seed will be highly contaminated with various fungi. Tests run at the Potlatch Greenhouse facility have shown up to 14 times more germinate mortality in Douglas-fir squirrel cache seed lots than climb and pick or fall and pick harvested seed lots.

In many of the squirrel cache lots, correlation between germination tests and greenhouse performance is very poor. Hand-picked cones, on the other hand, usually have operational performance closely related to current germination tests.

4. **Cone maturity monitoring and evaluation.** Training of field people responsible for the collection and handling is essential. Only by having trained people handle the harvest will the control items be adequately enforced.

Some individuals think that squirrels are the best indicators of cone maturity; however, remember that squirrels are interested in food, not 90+% germination seed! A good example of the squirrel's inability to evaluate cone maturity occurred in 1980. *Several seed companies collected *Abies grandis* cones in North Idaho from squirrel cache sources. The seed resulting from several hundred bushels had such low germination percentages that it was not marketable. This could have easily been avoided by people trained to personally evaluate cone maturity.*

Cone maturity evaluations should be initiated by mid-July. This will enable the field personnel to follow the ripening progress and enable accurate estimates for harvest dates to be selected. During this period, other important observations can be made that will affect the quality and amount of seed to be harvested. The observations will include confirming pollination (cut test) and following insect damage and intensity.

5. **Final planning and logistics.** Preparation is one of the most important steps following confirmation of the collectible cone crop.
  - a. Have adequate field personnel to handle cone maturity checks, to clean, bushel, and tag cones, and to provide area security and adequate daily cone storage.

- b. Have enough clean field collection bags. Dirty, previously used bags reduce quality enough to lower the percentage of the germination testing.
  - c. Have numbers, volumes, and species to be collected for each preplanned seed lot.
  - d. Give proper notification to the required number of cone pickers to handle the harvest. This would include the type of harvest, prices paid to collect, cut test specifications, acceptable maturity, etc.
  - e. Have adequate field storage racks and know the transport plans for moving cones for final drying before processing.
6. **Cone handling procedures.** The following guidelines will ensure quality seed from the cone receiving station to the processor:
- a. Cone pickers are required to turn in harvested cones daily. Filled sacks should be kept in the shade during the day and not stacked together, especially not in car trunks.
  - b. All cones are run over a cleaning table to remove debris, check maturity, perform cut test counts, measure for payment, finally label, etc., by the station operator.
  - c. The maximum of one bushel of cleaned cones is placed into 1.5 to 2.0 bushel loose-knit burlap bags. The bag is placed as quickly as possible on a portable field drying rack.
- Quite often, short distance transport of cones to a more central area is required. Since fresh-picked cones are quite susceptible to heating, arrangements must be made to have the green cones shipped immediately, unloaded, and reracked before heating damage occurs. Green cones can be stacked together for 1-2 hours; you can test for heating by putting your hands between the piled sacks.
- d. To promote seed lot homogeneity, the fresh field-racked cones should be allowed to "after-ripen". This simply means the cones should be kept for approximately a 2-week period in a shady, rather cool area; this allows the cones to slowly begin drying.
- During this time, the seeds in each cone have time to reach almost equal dormancy levels; if done properly, this can apply to the entire seed lot. After proper stratification, the result will be quick, even germinating seed.
- e. Following after-ripening, cones may be air-dried before shipment to the processor. If early shipment for long distances is required to reach the processor, precautions are needed to avoid cone heating. Potlatch Corporation has found, in its North Idaho climate, that 2 months of air-drying brings the seed moisture levels down to approximately 15-20%. At this level, there is no trouble with cone heating if the bags are tightly stacked for 24 hours. But each person responsible for collections will have to determine how best to avoid cone heating.
7. **The processor.** Supervisory people involved with the seed extraction operation are the vital, last link to achieve a 90+% germination seed lot. Asking questions, observing the process, and showing interest will help improve in-house operations or choose a quality seed processing company.

To conclude, the end product is no more than all the steps done correctly to achieve a goal. Since vigorous, high-quality seed is necessary to produce seedlings that meet rigid specifications, both field personnel who are responsible for seed procurement and nursery managers need to help each other through the controlled steps of the cone handling system from field to processor.