MINUTES OF MEETING

FOREST TREE NURSERYMEN

Wind River Nursery
Carson, Washington

August 23, 1956

Chairman F. W. Deffenbacher opened the fifth meeting of the Forest Tree Nurserymen and introduced the first speaker, Homer J. Hixon, Forest Supervisor, Gifford Pinchot National Forest. Mr. Hixon welcomed the group to Hemlock Ranger Station and the Gifford Pinchot National Forest.

Chairman Deffenbacher then introduced Mrs. Louisa A. Jensen from the Seed Testing Laboratory of Oregon State College, Corvallis, Oregon. Mrs. Jensen spoke on "Tree Seed Testing." Slides were shown of the various processes in making purity tests, germination tests, and other processes, such as moisture test, washing, stratification, etc. The care with which tests are made was stressed. It was pointed out that germination tests involved several methods in order to find the true optimum growth potential. In these tests the methods are listed with accurate counts to allow the recipient to calculate the germination curves, and hence, germination energy. She compared testing of tree seeds and agricultural seeds, and discussed some of the problems in tree seed testing, which has only been done in the last decade. A few of the research problems being undertaken with the guidance of the Forest Tree Seed Committee were mentioned. Mrs. Jensen's paper follows:

TREE SEED TESTING

Mrs. Louisa A. Jensen, Seed Technologist
Cooperative Seed Testing Laboratory, Oregon State College

MRS. JENSEN: Mr. Deffenbacher has suggested three phases of seed testing which might be of interest to you: First, the procedure for testing tree seed for purity, germination, and other tests; second, comparison of testing tree seed and agricultural seed; third, correct interpretation of testing results. All of these overlap to some extent, but each will be considered briefly.

First we will take an imaginary tour through the seed testing laboratory. When samples arrive in the office they are first sorted, given laboratory test numbers, and posted in our daily record book. Although we attach a pure seed envelope and a filing envelope, the samples remain in the container in which they are submitted. These containers vary. They may be of any type and size of cloth bag, paper envelope, or even tobacco cans.

Question: Is there any particular type of package which is better than others?

Answer: The spear envelope is the nicest for our particular use. These are paper envelopes which close by folding into a pocket. There are two general sizes that are most useable. For the larger seed such as pine, the 5 x 9 envelope is the correct size. For smaller seeds such as the spruces, the 3 x 6 envelope is better. On sensitive seed lots we have encountered damage by mechanical injury during transport in the mail. Some agricultural seeds are now being submitted wrapped in crepe paper wadding to avoid this difficulty.

When the samples leave the office, they are taken to the mixing counter in the purity room to be thoroughly mixed and a sub-sample drawn for the purity analysis. The samples are mixed with a mechanical divider and the proper weight is weighed out to be separated into the component parts of pure seed, other crop seed, weed seed, and inert matter.

Question: Approximately how many seeds are used?

Answer: For forest tree seeds the amount is dependent upon the size of the seed but compare with the agricultural seeds, in that approximately 3,000 seeds are used for the purity test. This would mean several hundred grams in large seeds, such as Sugar or Jeffrey pine, but only two or five grams in light seed, such as Sitka spruce or Western red cedar.

We do not normally find weeds in forest tree seeds, but occasionally other crop seeds, such as cereals, are found. We are told this is due to use of bags that have been used for grain. When making a purity test, a seed blower is used to separate the small pieces of stem, wings, or chaff that are lighter in weight than the normal seed. This method assists the separation of the various component parts. The test is completed using forceps and a hand lens with a magnification of $7\frac{1}{2}$. Next the purity analysis is checked by a supervisor for accuracy and taken to a sensitive chain-o-matic balance to be weighed. On the smaller samples the seed is weighed to one ten-thousandth of a gram. After the weights are made, the whole test is again checked by the purity supervisor for accuracy and completeness. From this analysis the percentages are calculated and the purity report typed. The sample is taken to the germination room for planting.

A vacuum counter is used for counting and spacing the seed. They are planted either in petri dishes on special paper toweling, or more often, they are placed on top of moist sand in plastic sandwich boxes. Many of the seeds are given check tests under a number of different conditions. For instance, Douglas fir is tested by three methods. Direct planting on sand, planting on sand with a two weeks stratification of 5° C. and soaking for 16 hours at 20° C., then given a naked stratification for 2 weeks before being planted on sand. All of these sub-lots are grown at a 20° C. to 30° C. alternation of temperature.

Question: How much water is used for soaking and what is the proper temperature?

Answer: We normally use 100 ml of water for each 50 seed of the larger kinds or 100 of the smaller kinds. After soaking at 20° C. and pre-chilling just above freezing, they are placed in germinators, the temperature of which may vary with the kind of seed. For instance, some kinds do best at 20° C. constant while others do best at 15° to 30° alternation. Most kinds respond to a 20-30° C. alternation.

Question: What do you mean by a 20-30° C. alternation?

Answer: The germinators are automatically held at 20° C. for 16 hours and at 30° C. with light for 8 hours. The tests are counted at weekly intervals until they are completed.

After the test has been made the remainder of the sample is placed in our file envelope with the separated component parts of the purity test to be filed for a period of 3 years. Thus, if there is any reason to review the purity test the seed is intact, except for the portion that has been used to make the germination test.

After the germination is complete, which generally takes a period of from 4 to 12 weeks, the report is typed and submitted to the sender. In typing the germination report on tree seeds, each method is listed separately and shows the total germination at the end of each week. From this report the growth curve is evident. The germination energy or vigor is closely correlated with the growth curve.

There are two other tests that are often requested on forest tree seed. One is the tetrazolium staining test and the other is a moisture test. For a moisture test the oven dry method is used; that is, a weighed amount of seed is placed in the oven and the percentage of moisture calculated when the seed has reached a constant weight.

Question: What type of container should be used to submit the seeds for a moisture test?

Answer: A metal container should be used. Metal containers similar to small sink top paint cans are very satisfactory.

Question: When is the best time to send seed for testing?

Answer: It should be as near as possible to the time you are going to use the seed. The heaviest season on agricultural seed is from August through October which fits in very nicely with the forest tree seed which are normally sent in a little later.

In evaluating tetrazolium tests, there are a number of points that need to be clarified, especially in relation to the interpretation of the results. Some embryos are stained strongly, some show no stain at all, and others may be only half stained, while still others are very weak in their reaction to the stain. We also find that there is no way to judge the seeds that would produce abnormal seedlings. Thus it is difficult to get a correlation with actual germination.

For comparison the rules for seed testing require that a seedling to be counted as germinated must be of normal appearance. That is, it should be capable of producing a normal seedling under ideal conditions. Thus rootless, poorly developed sprouts or ones that are sometimes called reverse germinations, where the cotyledons emerge first and the radical is held within the seed, are not counted as germinated.

Question: In your research do you like to know as much about the seed as possible?

Answer: Under our service testing it would add interest to know the storage conditions, age, and elevation collected.

Question: Do you do any work with X-ray methods?

Answer: No, we haven't. We are told that the X-ray method only shows the amount of development of the embryo. It, like the tetrazolium test, does not show which individual seeds may be expected to produce a normal seedling.

Question: Do you use sterile sand to grow the seeds in and do you have difficulty with molds?

Answer: No. We depend upon cleanliness to control molds. We are fortunate in having available washed river sand which does not need to be sterilized. It is used only once then discarded. We sometimes remove surface molds in petri dish tests by washing in a beet washer.

At the seed laboratory there are two different types of work that is done with forest tree seeds. Service testing follows the procedures that we have been discussing. There is also a research project under the guidance of the Northwest Forest Tree Seeds Committee dedicated to seeking improved methods of germination and allied problems. By using several methods for testing the service samples, data is being accumulated for germination techniques. However, there are many other problems that also need to be solved.

Question: Is there any place in the United States where all of the forest tree testing research data is gathered and compiled? Or do you exchange information with other seed laboratories?

Answer: Yes and no. I do not know of any one organization that collects and compiles the information on forest tree seed research. The Northwest Forest Tree Seed Committee disseminates any information concerning forest tree seeds to its membership. Mr. Roy Silen is here and can answer any questions concerning the compilation of reports that have been given before this group. The International Seed Testing Association has a committee on forest tree seeds that publishes data on various problems and have developed rules for standard testing methods. So far there are only one or two States that include forest tree seeds in their laws. Therefore, there have been no rules and regulations set up in North America for testing forest tree seeds.

Question: Is it true that you have a new test for forest tree seeds?

Answer: The test to which you refer no doubt is the one Dr. M. C. Parker has been developing. It is a quick viability test and has been found to be quite satisfactory on pine seed. The paper covering this work has been written, but has not yet been published. The test is accomplished by soaking seed in a solution of hydrogen peroxide, after the radical end has been removed by sandpapering. It will not take the place of a germination test, but it should prove to be of use for quickly evaluating seed lots. It can be completed in from 5 to 7 days, which is especially helpful on pine seed, as they normally need at least 4 to 12 weeks prechill. The peroxide test has been checked on several lots of both high and low value and the correlation with germination has been surprisingly close. In mentioning the need for research, it is easy to discuss the second phase suggested by Mr. Deffenbacher; that is, a comparison between testing tree seeds and agricultural seeds. Although hunting and agriculture were some of the first pursuits of man, it was not until approximately 1850 that there was a seed industry. Before that time, seeds were either saved by the individual or traded with his neighbor. Seed testing itself is not very old. It was only in about 1900 that the first agricultural seed was tested and methods have been developed since that time. In fact, it has only been within our generation that forest tree seeds have been tested. Because of the newness of seed testing, there are many unanswered questions. Not only in relation to seed testing techniques, but there are a whole host of questions both physiological and biological. Some of these answers are being found, but there is a great deal more research to be done, especially in relation to forest tree seeds.

Agricultural seeds having lived with man for many centuries have become accustomed to his care during periods of adverse weather conditions. For instance, many are dependent upon man to furnish the proper conditions for growth and survival of the species. Tree seeds more nearly parallel weed seeds which have not been "domesticated," but rather have had a need to build up their own set of resistance to unfavorable environmental conditions. They have to be able to grow only when factors will be favorable for continued growth. Not all seeds of any lot will respond to one set of conditions. Some need to stay dormant for a longer period for survival of the species. For this reason it is particularly difficult for seed analysts and nurserymen to furnish optimum conditions for all seeds at one time. Therefore, we probably will need to continue to grow seed under more than one condition in order to give individual lots the optimum for their particular needs.

The last question which Mr. Deffenbacher suggested was the interpretation of test results. You, as nurserymen, will best make your own interpretations. We can tell you how many methods we have used and how the seed lot has responded to the laboratory methods. However, each nursery will have a different set of conditions with relation to temperature, moisture, soil conditions, micro-organisms, etc. It will be necessary for each to correlate the laboratory results with the expected results on the basis of your experience. The seed analyst is striving to get the potential of a lot under optimum conditions rather than what the nurseryman may expect under specific conditions.

To summarize - Seed testing methods have been explained quite fully. The major volume of work in our laboratory is with agricultural seeds. We test 20,000 samples a year. Of these, approximately 300 to 500 are forest tree seeds. Because of the resistance of forest tree seed to methods used for agricultural seed and the many problems to be solved before their physiology is understood, it is really very thrilling to be even a small part in this field of endeavor. Thank you.

(End of Paper)

Some of the questions asked of Mrs. Jensen concerned the proper containers for submitting seeds, the best time to send the seed for testing, and the compiling of research data on tree seed testing. Mrs. Jensen also mentioned that Dr. Parker is working on a quick viability test, and that paper will be published soon.

After Mrs. Jensen spoke, Vern McDaniel, Oregon State Nursery, Corvallis, Oregon, complimented her on the work the Laboratory is doing on forest tree seeds. He said he thought the Laboratory is one of the best in the United States.

The next speaker to be introduced was J. R. Long, Superintendent, Duncan Forest Nursery, Duncan, B.C. Mr. Long presented some observations on exotics and mutant Douglas fir. He stressed the proper use of our native species in reforestation, but he felt the possibilities of the exotic species should not be overlooked. Careful study should be made of the site requirements and full consideration given to the various strains that might be available. He pointed out that experimental plantings of exotics on some of our problem and low quality sites should be encouraged. The first consideration in choosing the exotic to be planted would be the climatic limitations of the various species. Mr. Long distributed and reviewed a list of the exotic species growing at the Duncan Nursery which assessed the amount of damage sustained by each during last winter's severe frosts. Mr. Long said he would not try to draw any conclusions from the list, but hoped the group might get something out of it. Several people commented on their experience with the species he mentioned.

In conclusion, he discussed briefly "sports" in the Douglas fir. Mutant seedlings were passed out for the group to examine, and slides were shown of the mutant Douglas fir he had picked out as seedlings and grown separately. Some of the views shown were of "sports" 4 to 6 years old. Mr. Long commented that they die in the natural stands but seem to be fairly hardy in the nursery. In another year he plans to try grafting to attempt to increase them in that way. Mr. Long's paper follows:

SOME OBSERVATIONS ON EXOTICS AND MUTANT
DOUGLAS FIR AT THE DUNCAN NURSERY
by
J. R. Long, Nursery Superintendent

With the rapid depletion of our virgin forests here in the Northwest, many foresters have become concerned with competition in the world markets. Timber is now being produced in countries where the crop rotations are shorter and transportation costs, wage scales, etc. are considerably less than those in the Northwest.

In order for us to continue to hold our present advantage in the world markets, we must keep every acre of forest land productive and as far as possible endeavor to shorten our rotation.

I think most of us will agree, at the present time, that the best approach to these problems from the viewpoint of reforestation is through the proper use of our native species. Considerable improvement is possible in the plantations of the future through more careful selection of the trees from which cones are collected and the use of seed from superior strains. Closer attention should also be paid to the climatic conditions of the seed source in relation to the area to be reforested. In addition, methods of stand improvement, such as pruning and thinning, will further help us to obtain better plantations with increase in both yield and quality.

Although we have more or less conceded that our native species should have priority in reforestation, we should not overlook the possibilities in the introduction of exotic species.

In British Columbia our limited experience with exotic species has not produced any outstanding results, but this should not discourage us from further experimentation. Failures do not necessarily mean that certain species are not suited. Too often conclusions are reached from the results of one or two small plantations, sometimes on sites not suited to the species planted. Some of the failures, no doubt, could also be traced to the seed source. So before deciding that a particular species is of little value, careful study should be made of its site requirements and full consideration given to the various strains that might be available.

We feel that experimental plantings of exotics on some of our problem sites should be encouraged. Many of our high quality sites have been taken over since logging by brush and herbaceous cover to the extent that species indigenous to the area are not able to compete. Some exotic species may be found that would be able to compete and thus put these areas back into production without the costly and doubtful procedure of trying to eradicate the deciduous cover.