Chairman Webster: I think you have a good point there, Charlie. One word of caution: if you have a good system of crop rotation that is working out satisfactorily, you had better stay with it, because if you change to something you think may be better, you may be jumping from the frying pan into the fire.

Mr. Adams: I imagine it would depend on your soils quite a bit, but is a 2-year cover crop rotation system necessary?

Mr. Youngberg: Well, you use a 1-year, don't you?

Chairman Webster: No, we use a 2-year, and we feel it is definitely necessary.

Mr. Chapin: We do too, and we are on the heavy soil similar to what he is talking about, heavy clay soil, and we found 2 years absolutely essential and 3 better.

Mr. Youngberg: Some nurseries I know back in the Lake States use 1 year and some 2 years. I have never seen any data on comparative values of one against the other, but it depends a lot on the local conditions, and space quite often will be a limiting factor.

Mr. Adams: In our nursery, I get 2 cover crops in 1 year.

Mr. Youngberg: Well, you have about a 365-day growing season.

Chairman Webster: We have really two subjects in one coming up now, fellows, the Use of Chemical Dyes for Quick Germination Tests, and Recent Developments in Determining Tree Cone Maturity. If we can find a good method of quick germination tests, it will be very helpful to us. These two subjects will be presented by Mike Finnis.

Mr. Finnis: I think the logical way to start is to take the second question first, because you have to collect your cones before you can do anything with them. I should also emphasize that this applies to Douglas-fir, and also to this part of British Columbia, and any dates I might mention will most probably have no bearing on any other parts of the country.

RECENT DEVELOPMENTS IN DETERMINING TREE CONE MATURITY

by

G. M. Finnis

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It is not necessary to emphasize to you gentlemen the value and importance of fir seed since it is the basis of the livelihood of us all. Here, in southwest British Columbia we are anxiously waiting for the next good cone crop. In 1945 we had a bumper crop and in 1950 a good crop in some areas. Fir seed is now worth about $ 6. a pound and when the opportunity is given to us, we must gather all we can. That means we must start cone collections as soon as the seeds are ripe so that the maximum may be collected before the cones start opening and shedding their seed. Conversely collecting immature seeds is just a waste of time and money. The problem is simply "when to start cone collecting?"

Work by Maki in Idaho, Wakely in the Southern States, and Rudolf in the Lake States, and Fowler in California on different species of Pine indicated a relationship between specific gravity of the cone and the germinative capacity of the seed. As a result of these experiments it was decided, in 1949, to run a small study to try and determine when Douglas fir cones were ready for collecting. It must be emphasized that this was a small scale study. Cones were picked each week for 10 weeks from July 5 to September 13 ffom the same three trees on Southern Vancouver Island. The volume of the cones from each collection was found by displacement of water and, from each tree, three cones closest to the mean volume were used for the specific gravity test. Solutions of common salt were used to determine the specific gravity of the cones. The cones were placed in progressively stronger solutions of salt until one was found in which the cones just floated. Cones from two trees floated in water on September 6 and from the third tree on September 13. Before that they floated in an 8-12% solution of Sodium chloride and showed no tendency to change as the cones matured. The balance of the cones were air dried and the seeds extracted by hand. Germination tests were then made. These showed that germination was negligible of the seeds collected before August 16.

Between August 16 and 23 the germination rose sharply and by the 23rd of August was over 80% and remained at or above that level through to the last collection on September 28. Some of the cones started to turn brown about the middle of September and all were brown by the end of the month. The study showed that cone color and specific gravity of the cones were no guide to the maturity of the cones. This experiment is described in greater detail in B.C.F.S. Research Note No. 18. During the study the growth of the embryo, week by week, was very apparent. On July 19 the embryo could just be seen under the binocular microscope; on July 26 the embryo was about the size of a pinhead; and on August 2 it appeared to be about full size, though no measurements were taken. This gave us a lead which we followed up in 1950.

In 1950 cones were collected regularly from 8 trees which were just over 20 years old. The trees were 45 feet tall with a D.B.H. of 10.6 inches and had an average crop of about 2 bushels of cones per tree. This time embryo length and seed length were measured on selected cones. After each cone collection one cone was selected at random from each tree. From the selected cone 4 seeds were taken again at random from different scales of the central portion of the cone. The seed length and embryo length were measured, in millimetres, under a binocular microscope.

Thus, from each cone collection we had 32 measurements of seed length and embryo length. To show the growth of the embryo, week by week, embryo length was expressed as a percentage of seed length. That is shown by the black line in Figure 1. The red line represents "Real" germination percent. That is percentage of filled seeds that germinated. Two series of germination tests were run, one in the fall of 1950 and the other in the early spring of 1951. In each case the seeds were stratified in a refrigerator for 8 weeks at 40-41° F. After that a germination test was run for 15 days in a Hearson Incubator which was kept at 80° F. (26-27° C). After each test a cutting test was made of the ungerminated seed. The red line on the figure shows the mean of the two series of tests and is based on over 5000 seeds.

I think you will agree that there appears to be a close connection between embryo growth and increase in germination. If you accept an arbitrary figure of 75% as adequate germination, then the embryo should be just over 70% of the seed length. In 1950 that took place about August 20. As a result of this study, we felt that embryo growth appeared to be a simple and reliable guide to cone maturity. Therefore, we planned to repeat the study in 1951 on a layer scale. Unfortunately this proved to be impossible. We had prolonged hot weather and drought and an unprecedented forest closure. Collections could not be made as planned. Spasmodic collections were made from different areas whenever an opportunity arose. The embryo growth measurements were made on a larger sample than in 1950. A small graduated eyeglass was used instead of the binocular microscope. This proved very satisfactory.

The black line in Figure 2 shows embryo length as a percentage of seed length. It is at once apparent that there is much difference in embryo development in the two years. Here, in 1951, the embryo was fully grown, but not necessarily fully matured by the beginning of August. The germination tests in 1951 were carried out in the same way as in 1950, that is, two series of tests on stratified seeds. The results are shown by the red line on Figure 2. It is at once apparent that the trend of germination is anything but regular.

However, let me remind you that these tests were made on haphazard collections not on regular collections from the same stand. Early in August germination and embryo length seemed to be in step. Then came two drops in germination percent. I cannot explain that. Then germination rose again as in 1950. One point is apparent. The germination reached 75 percent a few days before August 20. That point seems to me to be significant. We still do not know if embryo growth is a guide to seed maturity. 1951 was a most unusual year climatically and the experiment could not be carried out as planned. But from the practical aspect we know, from three years work, that in this part of British Columbia, the cones are ready for collecting by August 20. That is the date on which our Reforestation Division usually starts cone collections. That date was based on experience over a number of years and these small studies have confirmed it.

THE USE OF CHEMICAL DYES FOR QUICK GERMINATION TESTS

by

G. M. Finnis

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The title of this discussion is "The Use of Chemical Dyes for Quick Germination Tests." Although I intend to describe mainly one test, it may be of interest to spend 2-3 minutes discussing germination tests in general and chemical tests in particular.

The ultimate object of any method of testing seed germination quality is to provide an indication of the percentage of seeds in a given lot that may be expected to produce plants, so as to determine the amount of seed that should be sown per unit area to give a desired plant density in the field. That may seem rather obvious but please bear it in mind. I may offend the scientific gentlemen present when I say that sometimes too much time is spent on an unnecessarily accurate germination test when the original sample was not selected with equivalent accuracy and the future use of the seed will also not be within such limits of accuracy.

Now I am no expert on the subject. These are just the observations of a beginner. But I sometimes feel that the ideas and impressions of the ordinary man are of more value to the general run of us than those of the experts. With Douglas fir we have been running germination tests for 50 days on unstratified seed and for 15 days on seed previously stratified. That takes a lot of time and a certain