Another group that we've become acquainted with over the past few years are the research people operating near Centralia, Washington with one of our very large forestry firms, the Weyerhaeuser Company; they have been doing some very fine work in forestry improvement. One of the problems, of course, all the geneticists and tree improvement people have is getting their super trees into seed orchards and so on and this has gotten the forester into the problem of grafting and so on with which horticulturists have been involved for many years. This has not been without its problems for them. To me, as a horticulturist, this problem they have run into is one of the most fascinating things I've seen in my many years in forestry; it is the fact that many of these Douglas firs will not accept their own seedlings as rootstocks. No one has been able to satisfactorily explain to me why this is. In other words, 30 or 40% of their super trees, when grafted back on their own roots, will develop incompatibility problems. But we've had the opportunity to get acquainted with Bill Webb here at Weyerhaeuser's research group and have met with him several times and today he's come down to talk to us about compatible and incompatible understock in forestry. Bill, we appreciate your coming to share with us what you have here today.

COMPATIBLE UNDERSTOCK IN FORESTRY

BILL WEBB
Weyerhaeuser Company
Centralia, Washington 98531

Weyerhaeuser Company has embarked upon a program of tree improvement aimed at increasing wood yield per acre on its lands through forest tree breeding. In a classic breeding program this means choosing a number of superior trees of seed-bearing age within our wild stands of timber, and genetically duplicating them by grafting to develop *seed orchards* designed to provide seed improved over that now collected from average trees in the wild. These seed orchards must produce consistently over a period of 30 years or more in order to meet reforestation schedules that call for planting new trees within one year of logging.

As you are aware, certain of our major tree species, notably Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) are inconsistent grafters, showing strong clonal variation in stock-scion compatibility.

Incompatibility not only kills a number of our grafts, but will obviously interrupt and delay seed production unless steps are taken to overcome or circumvent it. If we eliminate grafting then we must sacrifice the advantages it offers to the seed producer:

A. *Gains in time through:*
   1. Early flower production for continuation of the breeding program.
   2. Early seed production for forest regeneration.

B Gains in orchard management through the development of dwarfing rootstocks.

For our first generation of seed orchards we have accepted the use of grafting in propagating our clones. Therefore, in order to meet our seed production goals and, incidentally, to provide a broad genetic base for our program, we must guarantee the long-term productivity of our orchards through the development of understocks compatible with our plus trees.

In the rooting of compatible stocks, two basic methods could be used:

1 Scions of many clones can be grafted onto one rootstock.
2. Each rootstock can be grafted with scions from one plus tree clone

We have chosen the second method in order to:

— shorten the time to propagation of compatible stock in quantity
— give us the option to select from a broad rootstock base.

Here is the course we follow. Initial grafts of Douglas-fir are made from our "plus" trees onto seedling rootstocks which had their seed origin in the same area as the plus tree.

These rootstocks at the age of two years are each grafted with two scions from the same plus tree clone in accordance with the procedure developed by Dr. Don Copes for compatibility testing (1).

All grafts are later screened to identify those showing no visual symptoms of incompatibility. These are tested by Cope's destructive technique in sufficient numbers to isolate at least one compatible rootstock for each clone. Special attention is given to clones that are poor grafters. Compatible scion-stock combinations are then duplicated by rooting the rootstock and re-grafting to fill in the ranks depleted by delayed incompatibility. In Douglas-fir this depletion of incompatible grafts and replacement with proven compatibles continues through a period of 7 or 8 years where large numbers of clones are involved. At present we have rootstocks which are compatible with 350 of our plus tree clones, or approximately ½ of those in our Douglas fir seed orchards.

Obviously we would like to have a stock which is universally compatible with all our plus tree clones, stimulates flowering, controls height growth, and is free from susceptibility to pathogens and extremes of climate.

LITERATURE CITED

1 Copes, D. L 1967. A simple method for detecting incompatibility in 2-year-old grafts of Douglas-fir. *U.S. Forest Service Research Note,* Pacific NW Forest & Range Experiment Station.

AL ROBERTS· I'm sure we're all impressed with the sophisticated approach that both Bill's group here and Jim's are taking on these very serious problems in forestry. I think these two talks have served as sort of an introduction for our next topic and that's the matter of rooting these cuttings. I think you can see why horticulturists with their experience in the rooting of cuttings and so on might have become involved in this phase of interest to forestry at the present time. Over the past five years, through a grant from the Hill Foundation we've been able to devote quite a bit of time to the rooting of Douglas-fir at Oregon State University and we feel that this has great application to our propagation of conifers in the nursery trade in general.

Someone mentioned students yesterday and that we welcome these students. I'd like to introduce a few that are here today from Oregon State; at least they're supposed to be. Would you students stand up?

The one who will speak to us now is Dr. Kim Black. I noticed in the program, Kim, they didn't add that Doctor title to your name. He just freshly hatched and I'm sure it's important to him to have that prefix added to his name. Dr. Black finished his research program this spring and has done a fine piece of work. I am pleased that he was willing to come over here from Idaho to present this material to you We've had a lot of good graduate students in the past but he's one of the best. Kim is going to share with us just a portion of his work, particularly along the line of the selection of the shoot and its origin in relation to its rootability and so on. I think some of this material may be a review to some of you but I'm sure you're going to find some new material mixed in with this. Kim, we're pleased to have you this morning.