AN INTERNATIONAL PROVENANCE TRIAL WITh LARIX LEPTOLEPIS

W. Langner

Director, Institute of Forest Genetics and Forest Tree Breeding
Schmalenbeck, Germany

In view of the present state of knowledge, the lay-out of a provenance trial cannot be only for the purpose of proving the existence of genetical differences among populations. These trials should be especially to find suitable provenances for special sites and to have a glimpse into the genetical composition of the different populations as well as into the manner in which the genotypes are allotted in the natural distribution area. Furthermore it should also be determined how the genetical variation of each single provenance changes under different environmental conditions. Such information is surely of the greatest value for breeding research as well as for practical forest-tree breeding.

With regard to this delimitation any selection of seed stands essentially depreciates the value of such information of a provenance trial, on the strength of above stated conclusions regarding the usefulness of the different provenances for the sites in question, and there is a risk that the actually lucky strikes will not be found. For this reason I extended my trials with Larix leptolepis being overdue in Europe for decades, to provenances of the possibly most different altitudes and parts of the natural distribution area of this species. The seed-stands were selected by the Genetics Department of the Japanese Forest Experiment Station, Meguro, and financed by the Forest Administation of Hesse. From the slide you can see the site of 25 seed-stands at least as to their horizontal distribution. Because of the limited facilities of our Institute it was, unfortunately, impossible to include a larger number of stands in our trials this would have been desirable to include approximately all the genetical variability.

For the tests started by our Institute, we have laid out a series of trials on different kinds of sites, each of them containing, if possible, all provenances (in any case 25 sorts) in small plots of a simple lattice with mostly 6 replications in 5 blocks with 5 sorts each. The objective is to find those provenances that are unsuitable for planting on specific sites as a first step in elimination after about 10 to 15 years. When these short-term trials are completed it will be possible to lay out long-term trials with the remaining sorts that may be expected to be successful, eventually providing the sites with different provenances each corresponding to the result of the local short-term trials.

The above mentioned short-term trials have been complemented by laying out a nursery trial to be watched for 5 to 6 years only, and by adding a mean-term trial running more than 10 to 15 years to one of the short-term tests. The same design (simple lattice) has been used for these tests. There are differences only with regard to the size of the plots, number of trees per plot and spacing of the trees. The nursery trial is to show if it might be possible to eliminate at least the unsuitable sorts for a given site in less than 15 years and if there are any provenance differences. The result of the mean-term trial is to show if, on the whole. the decision after 10 to 15 years will have been correct. The distribution of the single short-term trials in the Federal Republic is shown on the slide as well as the cooperation of many European countries. In addition in the Federal Republic some German forest experiment stations have started long-term trials, partly in connection with our short-term trials. Japan has also started such trials using the same material. For America I handed seeds of most provenances to Dr. Klaehn, who has distributed the seed to additional interested people.

In addition, 10 breeding trees have been selected from each seed stand, whereof scions were grafted in Schmalenbeck and other places. Apart from the breeding objective of this action, which cannot be discussed here because of lack of time, it has also been planned to use these breeding trees for the lay-out of seed orchards of those provenances that do not fail in the short-term trials. Later on, clones of all provenances required for such seed orchards are to be obtained, if possible, from the seed stands, or if practicable, from the corresponding plots of the provenance trial itself.

There are of course no results yet of the short-, mean- and long-term trials. On the other hand the nursery trial has brought forth some information. Examination of all of the plants in each plot showed extraordinarily clear pro venance differences as to green in needle color (7 color-degrees) before yel lowing of 2-year-old larches in autumn. Generally speaking green becomes darker with higher altitude, increasing rainfall, and lower mean annual temperature in the area of the seed stands in question.

These first vegetation period differences have been confirmed by the second examination. On an average, those progenies yellow earlier that come from high altitude seed-stands, but there are, of course, clear deviations, (i.e. the seed stands of both the earliest and latest yellowing progenies are situated between 1300 m. and 1400 m. above sea level). But there is another provenance at the same altitude that keeps its green a rather long time, and another that is intermediate. The yellowing may be caused by one factor or several factors not always influenced by the altitude, or it may be that those populations differing in their yellowing originate by accident. There is the same tendency with respect to the mean annual temperature and the mean annual rainfall (i.e. generally the yellowing increased with increasing rainfall and with lower temperature).

There were also clear differences among the provenances with regard to the shades of their autumnal coloring. They varied from light yellow to dark brown.

Differences also were found among the provenances in the retention of needles in autumn. The trees in each plot were tested several times. After more or less equal shaking of the plants those of some provenances were still fully needled, some were without any needles, and others were intermediate. Apparently there are provenance differences in the start and duration of needlefall. This is, however, such an approximate evaluation that no further conclusions should be made at this time.

At the end of the vegetative periods in 1958 and 1959 there were significant height differences among the provenances. There were no correlations of the 25 provenances with the altitude, mean annual temperature or mean rainfall of the seed-stand site.

All results mentioned above refer to the test site at Schmalenbeck only. In other test areas, provevenance differences, correlations, and so on may deviate. Determination of such differences is one of the most important aims of this extensive and expensive provenance trial.