USE AND IMPROVEMENT OF DOUGLAS FIR IN THE NETHERLANDS

by

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SUMMARY

Selection and breeding work done in The Netherlands with Douglas fir is summarized. Results of provenance trials are being used in practice on a large scale. Both IUFRO series of 1966/67 and 1968/69 are discussed.
Seedorchard management is shown to be complicated due to several reasons. Future strategies are discussed.

INTRODUCTION

In the Netherlands Douglas fir [Pseudotsuga menziesii (Mirb.) Franco] can be considered as the second major forest conifer tree species. Considering the Dutch Long Term Forestry Plan Douglas fir is supposed to become an even more important tree species together with Scots pine (Pinus silvestris L.). From a total forested area of 300.000 ha some 16.000 ha is at this moment planted with Douglas fir. Before the year 2050 this should be increased to about 55.000 ha.
Douglas fir was first introduced to the Netherlands around 1860. This first introduction was quite successful. Since 1860 Douglas fir was used in plantations with varying success. It was later recognized that the source of the seed had much to do with the results in the plantations, but the provenance of the first introduction and of subsequent imports of seed are unknown.

Provenance research

In 1923 a fairly large-scale provenance study was initiated. In a period of 14 years some 35 seedlots of known origin in British Columbia (Canada) and Washington and Oregon (USA) were imported and 27 experiments containing 1 to 8 provenances were established. The results of these experiments were published by Veen in 1951 and de Vries in 1962.
Some of the provenances grew very well and proved to be well suited to the Netherlands. However by the time this conclusion was reached it was impossible to obtain more seed from these sources as the original stands had disappeared. The experiments were not designed well enough to allow a conclusive comparison of all tested provenances and the sampling of the natural range had not been extensive enough to provide a sound basis for delineation of the most promising seed collection areas for the Netherlands. Thus for import of seeds in the Netherlands available climatological data of the natural range had to serve as criterion for decisions about whether provenances were suitable.
A zone around the Puget Sound was designated for seed collection on the assumption that provenances from relatively dry zones would be most suited to the Netherlands.
When more experience was gained with source identified material it became evident that provenances from moister zones, for instance in the coastal area and at somewhat higher altitudes in Washington and on Vancouver Island, were to be preferred.
However it was unsatisfactory that the choice of provenances for import was based on climatological data without sufficient support from results obtained in provenance research. Therefore the need was felt for more extensive provenance research.
Through IUFRO this provenance research was made possible and two different series were established.
Of the first series (1966/67) 57 provenances from British Columbia, Washington and Oregon have been included in the Dutch research programme (Kriek, 1974 and 1979). Two trials were established.

Of the second series (1968/69) seed of 46 provenances and 58 individual trees collected in Oregon, California, Arizona, New Mexico, Colorado and Utah, United States, was received in the Netherlands and was subsequently included in the research programme (Kriek, 1975 and 1983). Three trials were established.

Seed stand selection

In the late fifties stands were selected on basis of phenotypical characteristics (stem form, branching habit, bark type, color of the needles), health and production in relation to site. Criteria were based upon results of studies in provenance trials established in the years 1923-1935. At the moment we have 45 seed stands covering roughly 70 ha.

Halfsib testing

In the late fifties and early sixties some 300 mother trees were selected in the seed stands. From each tree seeds were collected for halfsib testing. Eleven halfsib progeny trials were established. The trees in these progeny trials are now 25 to 31 years old. The results in these trials enabled us to select the 50 best mother trees on basis of height, growth and flushing behaviour of their halfsib progenies.

Seed orchards

The fifty best mother trees have been propagated vegetatively by grafting and are used to establish two seed orchards in the Netherlands (2 and 6 ha) and one (7 ha) in the south of France. The latter is located in France due to a more favourable climate concerning flowering in Douglas fir in general.

USE OF RESULTS IN PRACTICE

Provenance research

Results of the 1923-1937 provenance trials have been used in the past, but since the use of Douglas fir in the Netherlands is increased, information based upon the 1966/67 series IUFRO provenance trials was the main source for decisions what provenances could best be used in our country (Kranenborg 1985, Kriek 1974 and 1979). The results of the latest measurements in the 1966/67 series in 1987 up to age 20 years from seed match very well with the results up to age 10 years from seed in both the trials in Sleenerzand and Sprielderbos. Therefore the three earlier selected areas in Washington can still serve for seed supply for the Netherlands. These areas are:

a. East of the Puget Sound approximately from Arlington and Darrington in the north to North Bend in the south, covering parts of the seed zones 202, 403, 411 and 412 in the altitudinal ranges of 100 to 300 m.
b. In the south of Washington approximately from Cathlamet to the Pacific, covering parts of the seed zones 041 and 030 between altitudes 100 and 300 m.
c. In the northwest of Washington approximately from Matlock and Humptulips in the south at altitudes between 100 and 300 m to Lake Crescent and Louella Guard Station in the north at altitudes between 300 and 500 m.

The two provenances from Chilliwack, B.C. Canada grow and survive well to fairly well in both experiments. They flush rather early but may also be kept in reserve as good alternatives if no seed from Washington is available.

The 1968/69 series show a completely different behaviour in our conditions. Already in 1983 it was concluded by Kriek that none of the groups of provenances from this series reached the standards in terms of growth and flushing behaviour that lead to the selection of seed producing areas for Dutch forestry. In the meantime, two out of the three trials that were established with

the 1968/69 series were abandoned because of the loss of too many plants altogether. The one remaining trial in Leende now serves as an information plot for what can happen to material that is not at all adapted to our circumstances. There have been no measurements made in this trial since 1983.

Seed stand selection

The number of seed stands that are included in our National catalogue is periodically revised. About every ten years a new catalogue is issued in order for forest tree nurseries, foresters and other users of basic and plant material to know which stands are approved for seed collection.
For most of the forest tree species that are used in the Netherlands we do have more or less stands selected for this purpose within our own country.
For Douglas fir we have at this particular moment 45 seed stand that cover a total area of about 70 ha altogether.
The real problem with our supply of basic material of Douglas fir is not the number of seed stands nor the quality of those, but the lack of flowering and seed production as such.
Therefore, the option of seed stand selection did not prove to be a successful one concerning quantity. Nevertheless it is still an option to deal with, just in case we will get a very good seed crop some day. In the meantime there is always the possibility of seed harvests in one or two stands occasionally.

Seed orchards

In order to improve the genetic quality of Douglas fir in the Netherlands some 300 "plus-trees"were selected in Dutch seed stands in the late fifties and early sixties. A total of eleven halfsib progeny trials were established and the results in these trials enabled us to select the 50 best mother trees on basis of height growth and flushing behaviour of their halfsib progenies. In 1975 the first seed orchard was established in Vaals in the south of the country. A total of 36 clones were planted on 2 ha

on a distance of 5 x 5 meters. A few years later, in 1978 a seed orchard of 6 ha was established in Dorst, also in the southern part of the country. The spacing in Dorst was 6 x 5 meters. A total of 35 clones were represented in this orchard. Some of the clones were the same as in Vaals.
Expectations for regular flowering and seedbearing in Douglas fir in our climatical conditions were rather low. Therefore plans were made to establish a third seed orchard in the south of France. A location near Bordeaux, in Couze St. Front, was found and in spring 1981 39 clones were planted on 6 x 6 meters on a total area of 7 ha.
All three seedorchards of Douglas fir are State property and management is a common concern for our State Forest Service and the Forest Research Station.
So far we have not been particularly lucky with these seed orchards. There has been no cone production at all, which one could have expected at least in the 1975 orchard in Vaals and up till now the orchards only costed.
As it seems right now, the second orchard, the one in Dorst, suffers so much from graft-incompatibility and general instability, that it is probably going to be abandoned from proper management. The reason that an adjacent N.A.T.O. Army Air Force base claims part of the forest area in which the seed orchard is located has also somthing to do with this decision however. But the main problem can be found in the unhealthyness of the grafts.
Both the other two seedorchards in Vaals and in Couze suffer from the same problem, but in somewhat lower extend.
Operations with bark scoring methods have been executed and hopefully can the problem be postponed by this methods.

FUTURE STRATEGIES

The intended increase of reforestation with Douglas fir from 16.000 ha at this moment to a 55.000 ha before the year 2050 shows the need for good quality basic material that is fully adapted to our climate and circumstances.
As stated above for quite a number of years the strategy for seed-supply was focussed on results in provenance trials mainly. But at this particular moment it seems rather uncertain whether these original stands can be harvested in the future. They seem to vanish at high speed and new stands at the same locations are very often from different origin than the original stands from which the IUFRO series were collected. This reduces the reliability of the results of our provenance trials. Therefore it is important to find new ways of provision of adapted plant material of Douglas fir.

This we can reach by taking good care of the two remaining Douglas fir seed orchards and give them all the maintenance they need in order to keep the grafts healthy. Flowering stimulation is a subsequent item that should be given great attention in order to make full use of our seed orchards.
Establishment of one or two new seed orchards with either the same parents or with new selected parents (on basis of still existing progeny trials) is a necessity. Use will have to be made of improved rootstock families to give better compatible results concerning the grafts. Material will have to be obtained from the results of research of Dr. Donald Copes from the Pacific Northwest Research Station in Corvallis, USA.

Bulkpropagation of the thus obtained seedling populations is the next step to fulfil the need of the relatively large quantities of plantlets that are needed for reforestation.

Last but not least we can make profit of the many results that are already obtained in the USA. Seeds from seed orchards that are established with material of known origin are available on fairly large scale in the near future.
Recently we joined in a testing programme with different grades of quality of some of Weyerhaeuser Companies seed orchards. The seedlots we received in 1988 unfortunately failed due to a serious mistake some one made in the nursery. In 1989 we received new material and hopefully the results in subsequent provenance trials are such that we can make good use of this seed orchard seeds in the near future.

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