BREEDING BROAD-LEAVED SPECIES – WHAT IS GOING ON IN SWEDEN

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During the recent years approximately 300 million conifer seedlings have annually been planted in Sweden compared to the roughly 2-3 million broad-leaved seedlings (mainly birch). These small quantities explain why the financial resources for breeding broad-leaved species are quite limited and why the intensity in breeding varies for different species. Long- term breeding is for instance only carried out for silver birch. For other broad-leaved species it is a question of intermittent short-term activities. The outlines for breeding of different broad-leaved species are described in proceedings from the Nordic group of forest tree breeding meeting in Scotland 1993. Only the ongoing tree improvement activities for different species are presented shortly below.

Birch

Birch (*Betula pendula*) breeding in Sweden started in the 1940's but was ended in the 1960's due to the poor interest in birch. In 1988 the breeding activities began again with the objectives to improve: (1) climatic adaptation (2) stem quality and (3) growth. For all Sweden some 1300 plus-trees were selected, which include not only trees from Sweden but trees that were obtained from Finland, Lithuania, Germany and Poland as well. For most of these trees field tests, mainly as progeny tests but also as clonal tests, were established all around Sweden during 1990-1998. In approximately 5 years we will have results from all tests, which will make it possible to select trees for the breeding populations and for seed orchards.

Since the start two greenhouse seed orchards (Ekebo1 and Ekebo2) have been established. The seed is recommended for use south of latitude 59.5°. The annual mean seed production has been 3 kg, which covers the seed demand in south Sweden. In Sävar, Umeå there is another greenhouse seed orchard, to be used for latitudes 60-62°. It contains untested plus-trees.

Downy birch (*Betula pubescens*) is not included in the long term breeding, but extensive activities, such as selection of plus-trees to seed orchards after progeny testing will be carried out.

Hybrid aspen

A lot of intensive breeding work with hybrid aspen (*P. tremula* x *P.tremuloides*) was done during 1940-

1960's by the Swedish Match Company. Since it became cheaper to buy raw material elsewhere the company lost interest and the improvement work was ended. However, the interest in hybrid aspen was increased once more, when the discussions about alternative use of the surplus of agriculture land started in the middle of the 1980's. Thus in order to improve the reforestation material of hybrid aspen, SkogForsk selected 300 plus-tree clones in the old trials and in commercial stands south of latitude 60°. All 300 clones were copied as root cuttings and established in clonal tests in south Sweden during 1986-1991.

Today all 11 clonal tests have been evaluated, i.e. we have genotypic values for all 300 tested clones. Production in the oldest trials indicates that the yield will be at least 20 m^3sk/ha, year at a rotation time of 20-25 years when the 15 % best clones are used. By fertilisation and watering the yield can of course be much higher. However, the interest from the forest owners is today almost zero.

Since stem canker (*Hypoxylon mammatum*) is a very serious pathogen on hybrid aspen a minor inoculation test has been carried out in order to study genetic differences in sensitivity. This study will be evaluated this year.

Alder

A joint breeding project for black alder (*Alnus glutinosa*) started in 1995 between SkogForsk and the Lithuanian Forest Research Institute. Approximately 75 and 100 plus-trees were selected in Sweden and Lithuania respectively. Progenies from most of these trees were established in field tests in south Sweden and in Lithuania during 1998. Within 5 years the tests will be assessed in order to be able to select the best plus-trees for seed orchards. Since hybrids between *A.glutinosa* and *A. rubra* have shown high growth in some south Swedish stands such hybrids have been produced and were included in the Swedish progeny trials as well.

Oak and beech

For oak (*Querqus robur*) and beech (*Fagus silvatica*) the breeding activities have been and still are very extensive. For each species there are two seed orchards, established around 1960. They include selected plus-trees from south Sweden and Denmark. For some of these orchards progeny tests were established in the 1990's as well as two beech provenance trials which are included in an EU concerted action trial series were. Phenotypic selection of oak plus-trees for a new seed orchard is also in progress.

Since a lot of broad-leaved species in Sweden are at the border of their distribution there is a need of sufficient methods to test climatic adaptation. That is the reason why SkógForsk is involved in an EU study concerning frost hardiness in beech. The main objectives with this study is to develop methods for ranking beech material regarding growth rhythm and frost hardiness in order to improve the precision in deploying reforestation material. The study is under evaluation.

Ash, Linden, Maple Wild cherry, Mountain ash

Since there is a shortage of good domestic reforestation material of most "noble hardwoods" a great proportion is imported from Poland and Germany. However, we do not know if such material is suitable for Swedish climate conditions. Hence, forest owners using such a material are taking an economical risk. In order to increase the indigenous production of good seed 100 plus-trees per species of ash (*Fraxinus exelsior*), linden (*Tilia cordata*), maple (*Acer platanoides*), wild cherry (*Prunus avium*) and mountain ash (*Sorbus acuaparia*) were selected in a number of stands south of latitude 60°. All plus-trees were grafted and 25-60 grafts per clone were planted in 2-5 hectare large seed orchards in the very southern part of Sweden in 1991-1993. Funding needs to be found for progeny testing in order to remove low performing clones from the seed orchards.