

# A review of Scots pine and Norway spruce seed orchards in Finland

Teijo Nikkanen

Finnish Forest Research Institute, Punkaharju Research Unit

Finlandiantie 18, FIN-58450 Punkaharju, Finland

E-mail: teijo.nikkanen@metla.fi

The first seed orchards were established in Finland in the early 1950's. However, the large-scale establishment of seed orchards started in the late 1960's, and was completed by the mid 1970's (Fig. 1). The goal was to produce in seed orchards all the seed needed in nurseries and for direct seeding. In all about 3000 ha of Scots pine (*Pinus sylvestris* L.), and 300 ha of Norway spruce (*Picea abies* (L.) Karst.) seed orchards were established.



Figure 1. First generation seed orchards were established with phenotypically selected plus tree clones. Scots pine seed orchard in Central Finland photographed in the early 1980'.

Nowadays part of the early seed orchards have already been abandoned and there are 141 (2202 ha) first generation seed orchards registered for Scots pine and 25 (282 ha) for Norway spruce in Finland. The total number of plus tree clones grafted in orchards is 5903 for pine and 601 for spruce. The average number of clones (and the average area) in an orchard is 139 (15.5 ha) for pine and 75 (10.9 ha) for spruce.

In Finland almost all of the seed orchards of northern Finnish origin were located in the southern parts of the country. This was done in order to enhance flowering and to achieve better seed maturation. When clones originating from geographically and climatically limited areas, and from northern Finland were used in seed orchards established in southern Finland, it was assumed to achieve phenological isolation between the seed orchard clones and surrounding forests. However, no phenological isolation has been found, and background pollination has become a serious problem. The proportion of background pollination both in pine and spruce is often more than 50 %. This reduces the genetic gain, and adaptability of seedlings when used in areas where the mother clones originated. That is why the seed from the orchards of the northern origin is not utilised as far north as the mother clones were located (Fig. 2).

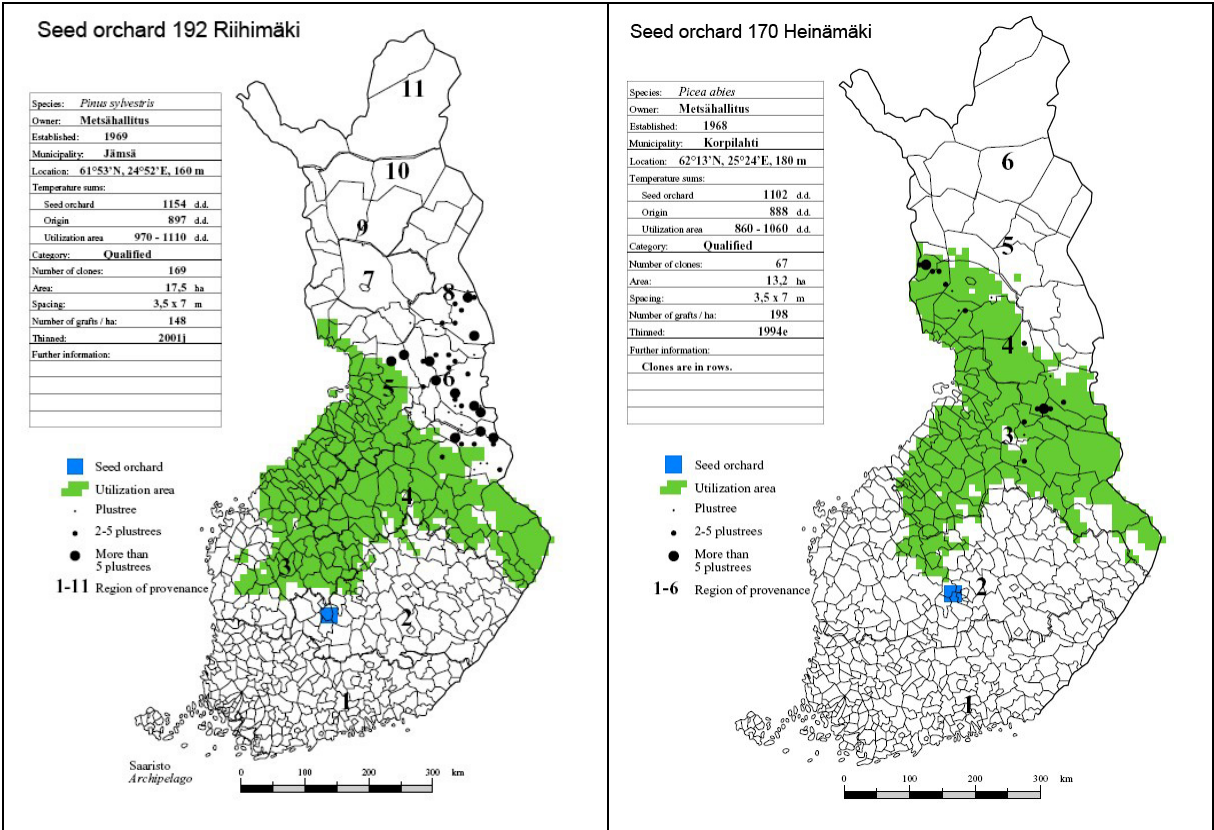


Figure 2. Examples of Scots pine and Norway spruce seed orchards originating from northern Finland.

All the first generation seed orchards are still in the production phase. Scots pine seed orchards produce enough seed for all the nursery use in southern and central Finland, and part of the seed needed for direct seeding. Because of background pollination the seed produced

by the orchards of northern Finnish origin cannot be used in the areas of mother clones. That is the reason, why in Scots pine the proportion of orchard seed used in nurseries has been only from 50 to 60 percent for the last 15 years (Fig. 3), although there is a plenty of pine seed orchards and the amount of seedlings used for planting has been reduced substantially. Situation in Norway spruce is quite different. Spruce seed orchards started to produce seed in older age than pine orchards, but after seed production had started the proportion of spruce orchard seed used in nurseries increased from 10 to almost 80 percent during the 1990' (Fig. 3). Insufficient flowering together with cone and seed damages have been the reason for the decrease in seed production during the last years.

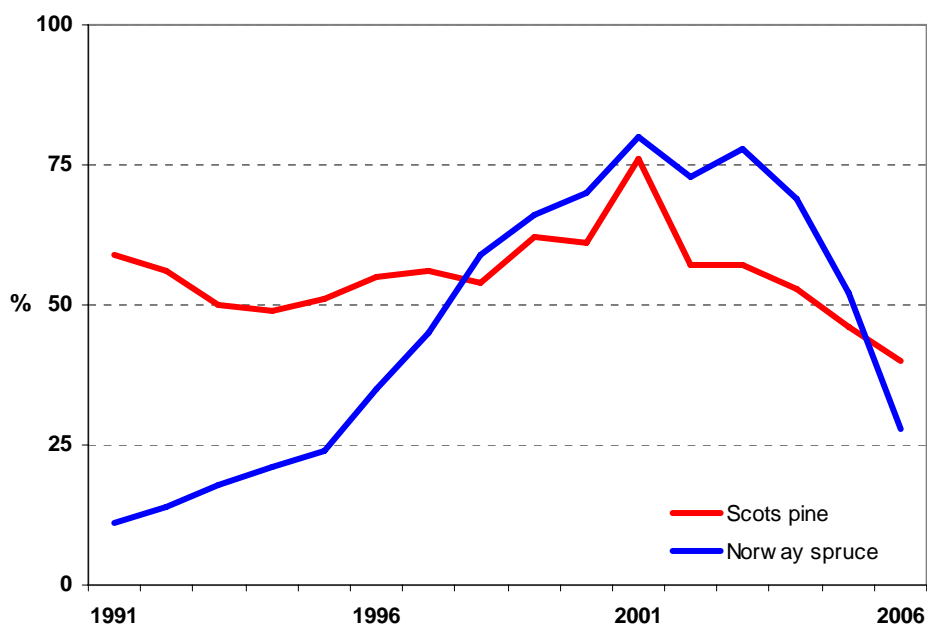


Figure 3. Proportion of orchard seed used in nurseries 1991 - 2006.

New generation of seed orchards, established with tested clones, started in the late 1990'. For the new seed orchards, the target to produce all the seed needed in the whole country in seed orchards was revised, especially concerning seed production for the northernmost part of the country and for direct seeding. The main target of the so-called 1.5 -generation seed orchards is to produce seed with as good genetic quality as possible. The plan is to achieve this by using the best 20 % (based on progeny tests) of the phenotypically selected plus tree clones. The aim is to produce seed with genetic gain about 10 % higher than in the first generation seed orchards. Only 20 – 30 clones are used in one seed orchard. The seed orchards for northern Finland are going to be established at more northern locations than the corresponding first generation seed orchards.



Figure 4. Scots pine seed orchard 406 (Seppälä) established in 1998 with tested clones.

A new master plan for forest tree seed production, made in 2003-2004 by a working group appointed by the Ministry of Agriculture and Forestry, was based on earlier programmes carried out in 1989 and 1997. The task of the new, broad-based working group was to evaluate the need for forest tree seed in 2005-2030, and based on this evaluation to revise the existing seed orchard programme. Annual need for Norway spruce seed orchard seed for nursery use was estimated to be 1827 kg, and that for Scots pine 542 kg. In addition, 3416 kg of Scots pine orchard seed is needed for direct seeding. The total seed orchard area needed for Norway spruce was thus 290 ha from which still 150 ha has to be established, and the total area for Scots pine was 610 ha from which 160 ha has to be established.

Because of the high establishment costs and long waiting time for the first crops, seed production in seed orchard is not a tempting business investment. That is why the working group recommended that the state should subsidy 85 % of the costs caused by establishment of seed orchards (excluding land costs) and tending of young orchards. Also decentralized seed production strategy, i.e. several independent seed producers, was recommended.