

ON THE APPLICATION OF FOREST GENETICS AND FOREST TREE BREEDING RESEARCH TO PRACTICAL FOREST SEED PRODUCTION

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SELOSTE:

METSÄNJALOSTUSTUTKIMUKSEN KÄYTÄNTÖÖN SOVELTAMINEN METSÄ-PUIDEN SIEMENTUOTANNOSSA

Forest genetics and forest tree breeding are of great importance to the solution of the problem of raising stand productivity, diversifying the composition of stands, and of shortening the rotation of commercial timber growing.

Until 1975, forest research institutes had carried out considerable research work into the problems of forest genetics, breeding and seed production. The result of this work has been the successful solution to a number of problems which are of great importance concerning the introduction of methods and technology for obtaining genetically valuable seed of the main forest tree species. Among these problems have been the following:

- the choice of criteria for the selection of plus trees as the breeding basis for the production of high-quality seed, for each main species and region separately,
- what are the basic elements of the technology for establishing and forming seed orchards and permanent seed collection stands,
- the experimental study of the possibility of obtaining in seed orchards hybrid

seed of Scots pine through intraspecific long-distance crossings,

- investigating the regularities of the growth, flowering and seed development of trees in seed orchards and seed collection stands,
- the study of methods of raising the productivity of the seed orchards of Scots pine (*Pinus sylvestris*) and European white oak (*Quercus robur*) by using a whole complex of mineral fertilizers, foliar sprays with nutrients and physiologically active compounds, and also through crown pruning and controlling insects harmful to seed.

Another positive result of the research has been the experimental and numerical data concerning the economic value of seed orchards.

The development of the scientific basis for the production of high-quality seed led to the introduction of a large part of the research findings in forest genetics and forest tree breeding into practical forest seed production. Since 1971, work has begun in forest enterprises on the establishment of a permanent seed supply for

the main forest tree species — *Pinus sylvestris*, *Picea spp.*, *Larix spp.*, *Quercus robur*, *Haloxylon spp.* and nut trees. Notable achievements in this work have taken place in the current five-year period.

The working methods in the field of the production of high-quality seed have been laid down in the new edition of the «Main Regulations of Forest Seed Production in the USSR». These regulations have been prepared in accordance with the results of the work in forest genetics and forest tree breeding in the past few years. The establishment of clonal and seedling seed orchards and also permanent seed collection stands were recommended as the main methods in organizing seed production. The utilization of logging areas in naturally high-productive stands for temporary seed collection is also considered.

The basis for forest tree improvement is a gene pool which is built up using mass and individual selection of valuable forms in natural populations.

The organizational methods of forest seed production are separated according to the biological properties of tree species, the target of the forest economy and the conditions in each forest zone. In accordance with a long-term programme up to 1990, which stipulates a change to seed production on the basis of breeding, an inventory of 13,2 mill. ha of the best high-productive stands has been carried out for breeding purposes in the state forests up to 1978. As a result of the inventory, about 7 000 ha of plus stands have been selected and after a proper check recorded in a state register. A total of 9 453 ha of seed orchards and 141 253 ha of seed collection stands have been established in the country. In 1977, 457 tons of seed of coniferous and broadleaved species were collected in seed orchards and seed collection stands.

The magnitude of achievements needed to secure a permanent seed supply, according to different species, can be seen in the attached table.

The first stage of the long-term programme is planned to be completed in 1980. The establishment of the seed supply will then have been completed in the European part of the country. To achieve the second stage of the production of improved seed — the

establishment of clonal high-quality seed orchards — the evaluation of the genetic properties of plus trees has to be completed.

A broad application of the research results concerning forest genetics and forest tree breeding to the practice of the tree seed production has shown that recommendations for advancing the forest seed production to a genetic basis need to be more specific and need to be given a more concrete expression; factors which also have to be taken into account include the variation in environmental conditions, the species composition of stands, and trends of forest utilization in different regions.

In order to increase the effectiveness of the practical work on the production of improved seed the following points are particularly necessary:

- to perfect the technology for establishing and growing seed orchards and seed collection stands of different species in various forest zones,
- to develop more effective methods of speeding up the onset, limiting the periodicity and intensifying the flower production of seed orchards,
- to develop the production system for high-quality and elite seed production based on mass production of hybrid seeds,
- to develop the methods for long term storage of large seeds, especially of oak.

It is also necessary to solve a number of organizational problems, in particular, to determine the optimal size of seed production units and their distribution in relation to forest zones and seed production regions, and also to develop the machinery and mechanized systems for pruning, fertilizing, and collecting and processing of tree seed.

Experts are of the opinion that it is advisable to single out the best seed-producers among the selected clones. In this connection, it is necessary to have a more reliable estimation of the relationship between the flowering intensity and the time of the onset of flowering on one hand, and the growth and the productivity of trees and stands on the other.

In the past few years many scientific organizations have concentrated their efforts on the research of geographic variation. The results of the experiments made earlier on

geographic variation and now being carried out again by scientists in cooperation with forestry practice, have made it possible to start the preparations for a division of the European part of the country, Siberia and the Far East into seed production districts for *Pinus sylvestris*, *Picea abies* and *P. obovata*, *Larix sukachewii*, *L. sibirica*, *L. dahurica* and other *Larix* species, *Pinus cembra sibirica*, *Abies alba*, *A. nordmanniana* and *A. sibirica*, *Quercus robur*, *Fagus sylvatica* and *F. orientalis* and *Haloxylon* spp.

Along with, and on the basis of, the preparations for a division into seed production districts, scientific and project organizations are developing a general scheme for the development of genetically improved forest seed production of the main forest tree species for the whole territory of the country. This will make it possible to determine the extent of work to be done and the location of the seed production units.

SELOSTE:

METSÄNJALOSTUSTUTKIMUKSEN KÄYTÄNTÖNSOVELTAMINEN METSÄ- PUIDEN SIEMENTUOTANNOSSA

Metsänjalostuksella on suuri merkitys metsiköiden tuotoksen lisäämisessä ja kokoonpanon monipuolistamisessa sekä kiertoajan lyhentämisessä. Vuoteen 1975 mennessä metsätutkimuslaitokset olivat selvittäneet monia asioita, kuten pluspuiden valintaperusteet, siemenviljelysten ja siemenkeräysmetsiköiden perustamisteknologian, mahdollisuudet tuottaa männyllä kaukoristeytys-

siementä, siemenviljelysten ja siemenkeräysmetsiköiden puiden kasvun ja siementuoton säännönmukaisuudet sekä mahdollisuudet lisätä siementuottoa erilaisilla toimenpiteillä.

Tutkimustulosten pohjalta on lähdetty laajoihin käytännön sovellutuksiin. Aikaansaannokset vuoden 1978 alkuun mennessä ilmenevät taulukosta 1, jossa ilmoitetaan tiedot pluspuiden, siemenkeräys-

metsiköiden ja siemenviljelysten määristä seuraaville puulajeille: mänty, kuusi, lehtikuusi, sembramänty, tammi ja koivu. Käytäntöä varten on laadittu uudistettu versio kirjasta »Yleisohjeet metsäpuiden siemenhankinnasta Neuvostoliitossa». Metsänjalostuksella on vuoteen 1990 ulottuva pitkän ajan suunnitelma, jonka ensimmäinen vaihe päättyy vuonna 1980. Ohjelmaan sisältyvät biologiset, teknologiset ja organisatoriset tehtävät. Tavoitteena on perustaa optimikokoiset siementuottoyksiköt kutakin metsävyöhykettä ja siementuottoaluetta varten kaikilla pääpuulajeilla koko Neuvostoliiton alueella.

Table 1. Achievements in the establishment of a permanent supply of genetically improved forest tree seed in the USSR.

Achievement	Unit of measure	Achieved by Jan 1st 1978	Species					
			Pinus sylv.	Picea abies	Larix	Pinus cembra	Quercus robur	Betula
1. Area of stands where a genetic inventory has been made	1 000 ha	13 240	4 825	2 402	265	1 611	489	440
2. Plus trees selected	Number	14 883	7 612	3 256	541	52	1 500	89
3. Plus stands selected	Ha	6 960	3 573	1 318	78	129	1 421	7
4. Seed orchards established	Ha	9 453	5 171	1 470	720	1	250	—
5. Of which, tested and included in the permanent seed supply	Ha	1 799	1 064	242	121	—	19	—
6. Of which in flowering stage	Ha	728	432	31	39	—	14	—
7. Seed obtained from seed orchards in 1977	Kg	756	142	1	14	—	—	—
8. Seed collection stands established	Ha	141 253	76 072	7 772	11 073	8 758	16 723	200
9. Of which, tested and included in the permanent seed supply	Ha	122 818	45 621	2 640	7 915	8 758	15 604	100
10. Of which in flowering stage	Ha	62 491	15 412	1 308	3 978	8 758	14 240	10
11. Seed obtained from seed collection stands in 1977	Kg	480 837	11 378	143	27	—	272 414	180