Seed Orchard Planning and Management in Turkey

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Tree breeding studies have been started at 1964 in Turkey. Two sample seed orchards were established at the training area of Faculty of Forestry of Istanbul University in 1964 by using 10 clones. Because of low clone number, production was not aimed in those seed orchards. Later, it was aimed to establish seed orchards by the purpose of seed production. For this reason, seed transfer regions were determined for the economically important tree species. Plantation areas and seed requirements were assessed for each species. Selection of seed stands and plus trees from seed stands were followed by clonal seed orchard establishment with grafted seedlings. First clonal seed orchard was established at 1976 by *P. brutia*. Breeding studies had been continued in this manner until 1993. Seeds orchards established in that time generally contained 30 clones and were not tested genetically.

The National Tree Breeding and Seed Production Program (NTBSP) for Turkey were implemented at 1994. *Pinus brutia, Pinus nigra, Pinus sylvestris, Cedrus libani and Fagus orientalis* were determined as target species. It was aimed to meet seed demand of 150.000 ha/year plantation for those species in the program. By considering seedling number per hectare and seed amount needed for a seedling, seed requirements were determined for each species. Seed sources (seed stands and seed orchards) were planned according to seed demand of species. Breeding studies have been accelerated by the progeny trials by this program. In addition, seed orchards were established by higher number of clones (41-152 clones).

By the year 2006 there are 174 seed orchards occupying 1200 ha in Turkey. Ninety two percent of seed orchards have been established by *Pinus brutia*, *Pinus nigra*, *Pinus sylvestris* and *Cedrus libani*. All of the seed demands of plantations are supplied from seed orchards for the first 3 species. Since seed production by *C. libani* takes longer time, seed production in seed orchards is not sufficient to provide seed requirement of plantations. All seed orchards are phenotypic. However, two seed orchards were established by *P. brutia* in two breeding zones according to the first results (4^{th} year) of progeny tests. These two seed orchards will be converted to genotypic seed orchards at the end of progeny tests. Any results of progeny tests in other breeding zones have not been obtained yet.

Table 1. Seed orchards in Turkey

Species	Minumum clone	Maximum clone	Seed Ochard Number	Total Area (ha)
Pinus brutia	10	146	67	472,2
Pinus nigra	10	122	52	431,1
Pinus sylvestris	10	152	20	111,3
Cedrus libani	15	55	12	66,0
Pinus pinea	30	30	4	47,2
Picea orientalis	30	50	9	30,5
Pinus halepensis	10	20	2	8,2
Liquidambar orientalis	30	30	1	2,2
Sorbus torminalis	59	59		-[a]
Pinus nigra var. pyramidata	20	21	2	4,3[b]
Pinus nigra var. *pendula*	8	8	1	1,2[b]
Pinus nigra var. *seneriana*	10	10	1	1,8[b]
Pinus brutia var pyramidalis	18	18	1	1,2[b]
Pinus sylvestris var. *compacta*	8	26	2	4,8[b]
		Total	**174**	**1182**

[a]Scions were grafted, it will be established in next spring, [b] seed orchard for *exsitu* conservation.

Research that would guide seed orchard management was limited before NTBSP in Turkey. So implementations about management had been limited by protection and renewal. In that time, seed orchards are surrounded by a fence against animal attacks. Field between seedlings is harrowed by disc harrow each year. Seed orchards were surrounded by trees to isolate from pollen contamination. Although there is no serious problem related to insects, pest management is also done. The researches considering seed orchard management have been begun after NTBSP. Research projects including studies about flower counting, pruning, hormone application and molecular genetics have been started and some of them have been finished. Knowledge that could be gained by acceleration of this kind of studies will improve applications of seed orchard management in future.