The objective and scope of Pennsylvania's Tree Improvement Program was outlined by Jack Winieski, Forest Geneticist in the Department of Forests and Waters, at the Region 7 Nurserymen's Conference held at Mt. Alto in 1962. The basic program has not changed. The species included have not changed, i.e. White Pine, Japanese Larch, Norway Spruce, Virginia Pine, European Larch, and Pitch Pine. Emphasis has been switched slightly to facilitate progress. For instance, efforts have been concentrated on a single species each year with somewhat lesser concentration on one other species. This hastens the establishment of any one orchard and simplifies all operations. Less concentration on the one other species yields small quantities of plant material and reveals problems peculiar to the species. These problems can then be planned for the following year when the species receives major concentration. One other switch on emphasis has been the species themselves. Based on long range nursery planning, less emphasis is being placed on Pitch Pine and European Larch, with more emphasis on Virginia Pine.

At the present time we have nearly 100 acres of Seed Orchard sites cleared and in various stages of development. There are two sites at Penn Nursery in the central part of the state, consisting of 20 acres and 25 acres respectively. In the north central part of the state at the Clearfield Nursery, there is a 45-acre site. One other 8-acre site is located in the south central region at New Germantown.

All of the sites are located adjacent to an existing operating Department nursery with the exception of the 8-acre site. With an adjacent-to-nursery location, the availability of equipment, labor, irrigation system potential, and supervisory personnel proves to be a tremendous advantage.

Perhaps of more interest to this group would be some of the problems encountered in our Tree Improvement Program relative to the actual establishment of the Seed Orchards. The methods of solution to some of the problems may also be of interest.

Some of our problems were anticipated and initially planned for. Some were not. Among the anticipated problems, three of the major ones would be:

1. Pollen contamination sources.
2. Soil erosion in the Seed Orchards.
3. Deer damage.

In regard to pollen contamination, our sites for the most part are located in large holdings of °State Forest Land where control of contaminating species will not be difficult. Private land near one of the sites presents no apparent problem.

The slopes on the two sites at Penn Nursery range from 6% to 30% with the average being about 15%. Soil washing has been checked in three ways.

1. Contour ditches were made at time of clearing.
2. Check dams were constructed by staking wooden planks in eroded ditches.
3. Attempts were made at establishing permanent sod cover. This was desirable for other reasons as well which will be mentioned later.

Deer damage was controlled by placement of 8 foot stock fences around the sites.,

When the sites were originally chosen at Penn Nursery, it was believed that the fertility would be high enough to permit initial establishment of the grafted stock. However, as clearing commenced, stump disposal was accomplished by digging huge pits on site and burying them. This left large areas of exposed subsoil which of course were not suitable for transplanting the grafted selections.

For plant establishment, the first thought was to make a hole to receive a good topsoil mix. We tried a regular post hole digger with a 12 inch bit to make the hole. This was unsuccessful in shale and rock. We then resorted to a local line construction company who has a 24 inch auger bit mounted on a 2-1/2 ton truck. This method worked well and gave us a hole roughly 2 foot in diameter and about 2 foot deep. Also, the soil removed from the hole was distributed evenly around the hole itself which we were to find later on, has a greater advantage over a back-hoe dug hole.

These holes were then filled with a mixture of 1/3 topsoil, 1/3 subsoil, and 1/3 rotted sawdust. After filling and allowing for air pockets to settle, a saucer was worked up around each hole. This was done to aid in catching and holding rain, to aid in holding fertilizer, and also to hold winter mulches in place.

Careful hand planting in these saucers has given very good survival, as high as 95% on most plantings. This has been in drought years and with the lack of an irrigation system.

At the time of planting, one handful of Superphosphate was added to each saucer to stimulate root growth for better plant establishment. In most cases, close supervision is needed to see that correct planting techniques are applied and also -that the right graft gets in the proper location in the orchard.

Large areas of exposed subsoil on our sites was mentioned before. This also posed a problem for establishment of a sod cover which was needed, not only to stabilize the soil but to help raise the organic matter content. Initially, annual pasture rye was sown on both sites at a rate of 2 bushel per acre. Before this, a complete fertilizer , 5-20-10, was applied at 1/2 ton per acre. On spots that are exceptionally poor, rye has been resown and fertilizer reapplied. Otherwise the rye is allowed to resow itself each year. When a state of dead-ripeness is reached (usually about the third week in August in our area), at which time the seeds readily drop or can be shaken from the head, we mow to a height of approximately 5 inches with a 5 foot rotary tractor-mounted mower. This must be done when the rye is dry to get a good broadcast-sown effect from the cutting. In some instances, in order to cover the seed and assure moisture for germination, the site was worked up with a rooter-plow. This year it was not rooted inasmuch as the rye crop was quite heavy and the straw left provided enough mulching effect for retention of moisture for seed germination. Our rye is doing very well on most areas of the sites.

Kentucky 31 Fescue, Creeping Red Fescue, Smooth Brome, Orchard Grass, Red Clover, and Alsike Clover have also been sown. These have been successful to varying degrees. In most cases the lack of success was primarily because adequate moisture was not available for germination and establishment. Our best success has been with the rye.

The transfer of grafted material and holding of material should be considered in any Seed Orchard Program. Our greenhouse facilities are located at the Mont Alto Nursery in the southern part of the state, while our three biggest orchard sites are in the north central part approximately 120-150 miles away. Potted grafts are carefully packaged in crates and shipped to the Seed Orchard sites by truck. Upon arrival, they are immediately planted or stored in shady, cool places for 1-2 weeks. Any plants that need to be held longer can be put in a special transplant area at the nursery where irrigation is available. Material handling is also greatly facilitated by

concentrating on one species each season or until an area in the Seed Orchard is sufficiently complete for unit management .

Needless to say, an irrigation system would be a great advantage to any seed orchard establishment and in itself would solve many problems. We now have extended our irrigation system at Penn Nursery to include the one 20-acre site. The 25-acre site will be included as our nursery irrigation system undergoes further expansion.

There is one other point that should be emphasized and that is to keep any seed orchard establishment program as flexible as possible. This can be very helpful when an unforeseen problem arises. For example, about one-half of our 20-acre site at Penn Nursery was originally planned for Norway Spruce. We had very poor success in grafting Norway and consequently very little plant material was available to fill the designated portion of the orchard. With little difficulty, this portion of the orchard was converted to Japanese Larch and now is nearly complete and can be managed as a unit .

I have mentioned a few of the problems we had in establishing Seed Orchards, mostly focusing on the Penn Nursery sites. I hope that you may benefit from some of our experiences.

I should also mention that in addition to Seed Orchards, two plantations of Norway Spruce have received treatment as seed production areas. An established 2.5 acre area is located at the Mont Alto Nursery. A 4.2 acre area located at the Clearfield Nursery is presently receiving its second rouging. Other treatments will follow.

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