decrease in the labor required to raise the seedlings. With occasional use of a helper during heavy sowing weeks I was able to easily produce all the seed flats for the season. The time saved in running around looking after seedlings was used to better supervise the cutting operation. The result was an increase in both quality and quantity of material with a decrease in the number of people required to get the job done.

Our growing room cost over $16,000 to build and will take years to pay for itself. It is difficult to place dollar values on improvements in quality and savings in time by a salaried grower. All plants, except salvia, grown in this room showed a distinct increase in quality so that use of this room has proven highly advantageous to our bedding plant operation. Its 400 sq. ft. are equivalent to 2,000 sq. ft. of greenhouse space. Its artificial environment is unaffected by the time of year or the weather so that the results are more predictable. With the high turnover rate due to rapid seedling development, the room can easily handle an operation twice our size. So as our needs increase the room will become even more valuable to us.

SEED BED PRODUCTION IN RHODE ISLAND

LARRY CARVILLE

Horticultural Associates

Tolland, Connecticut 06084

Production requirements for any seed bed operation must be a determination by top management. This decision should be periodically reviewed and kept current with market demands and production costs. If a production facility can economically purchase seedlings to fill its market needs, it should not consider seedling propagation. Certain specific needs must be considered by each management staff in reaching its decision. Some of the relevant areas are: 1) Propagation needs of the firm; 2) Seasonal planting requirements; and 3) Reliability of delivery capabilities.

The Rhode Island Nurseries, Inc., Newport, Rhode Island has always maintained a seedling production capability to meet both its propagation and production requirements. This policy is reviewed annually to reflect current needs and market trends. Great importance is attached to the needs of the propagation division in having a ready supply of understocks for grafting and for lining out.

Production output of the seedbeds is not intended to produce salable seedlings. However, if surplus quantities are pro-

duced from any given crop, these items may be offered to the trade. Seed beds are maintained on a two year program and no seedlings are retained in the seed beds beyond this time.

Seed bed construction and maintenance. All seed beds are prepared during late summer in a reserved portion of the propagation facility. The planting area is first wheel harrowed, dressed with cattle manure, then deeply rototilled with a 100 inch Howard Rotovator. The area is then leveled by hand raking; beds are staked out and the seed beds are constructed. One by three inch edging strips are placed vertically along two perimeters of the seed beds. These strips are held upright by iron hooks which are hammered into the soil. The beds are constructed to measure 68″ between the two edging strips. The length of the beds is determined by available space.

After the strips are in place, the planting area is rolled lightly with a slightly weighted lawn roller. Seed is hand broadcast to the desired density and lightly rolled into place. A covering of ⅓ sand, ⅓ peat and ⅓ perlite is placed over the seed to a thickness of ¼ to 1 inch, depending on the size of the seed.

If the seed bed is sown in the fall, salt or marsh hay is spread over the covering and snow fence panels, 4 feet by 6 feet, are placed over the beds. These panels are supported on both ends by the edging strips and will remain in place over the winter months. The panels keep the mulch in place, keep animals from disturbing the seed beds and define the planting areas for the workers.

In early spring, when seed germination is apparent, the hay mulch is carefully removed but the panels remain in place to provide shade protection for the young seedlings. The above process is repeated for all spring sowing except that the marsh hay is not applied over the seed beds. In both cases, the shade panels remain in place over the beds for the first growing season. As soon as growth exceeds 4″ to 6″, the panels are raised on T-irons to allow the seedlings additional room to develop.

Seed beds are hand weeded on a regular basis with two-person crews, one person working from each side of the 68″ wide bed. Seedlings are thinned as required during the early weeding operations. No herbicides are used in the seed bed areas. Paths between the seed beds are kept clean by rototilling and weed population on the perimeters of the seed bed is kept down by mowing and periodic applications of Paraquat.

Harvesting. Deciduous seedlings to be used as understocks or for lining out are harvested in late fall after the first hard frost. Usually, this occurs in late October in the Newport area. Seedlings may be lifted with a bed lifter or may be hand spaded

from the beds. All seedlings are processed bare root, placed in boxes and stored in a large cooler to await grading and trimming. *Acer palmatum* 'Atropurpureum,' *Fagus sylvatica* and *Cornus kousa* seedlings are graded into two sizes. Number ones will be stored over the winter in peat/perlite and will be potted in 2½" rose pots the following March. Number two seedlings will be stored in a similar manner but will be potted in 2¼" standard pots during March for a lighter grade understock. These understocks will be grown on for one season prior to moving into the greenhouse during November of the second year for grafting.

In many cases, seedlings of *Cornus kousa* make sufficient growth during the first season so that they may be graded and potted immediately after harvesting. They are then moved into the greenhouse in November to be used as understocks during the winter grafting program. Deciduous seedlings such as *Myrica* and *Viburnum* are harvested in the spring from the seed beds, graded and moved directly into the field planting operation.

Picea excelsa and *Cedrus deodora* are harvested from the seed beds in early fall. They are dug bareroot, graded and potted for use as understocks. Number two sizes are potted in 2¼" standard pots and are carried along during the winter in a cool house. They are then moved outside in the spring, grown on and moved into the greenhouse for use as understocks that winter.

Conifer harvesting. Other conifers harvested during the late summer after two growing seasons in the seed beds include *Taxus cuspidata* (Syn. T. *cuspidata* 'Capitata'), *Picea pungens* and *Pinus strobus*. These seedlings are graded, trimmed and transplanted to be grown on for two more growing seasons. At the end of the fourth year, these 2 plus 2 liners will either be transplanted directly to the field for growing on or, in the case of some of the smaller grades of *Pinus strobus*, they will be set aside for understocks. Two year seedlings of *Pinus thunbergiana* are harvested directly from the seed bed in early spring and after grading, are transplanted directly to the field.

Seed sources. One of the most important ingredients in any successful seed bed production program is a constant and reliable seed source. These sources should provide information with the seed order, such as year of harvesting seed, elevation of seed source, name of strain (if applicable) and how long the seed has remained in storage. Accurate record keeping of this information is essential and when a seed source no longer proves to be reliable, these records will provide the propagator with information upon which to base his decision. An unreli-

able seed source is an unjustifiable luxury. Certain species of seeds may be available locally and, where practicable, they should be harvested. Some of the species which we picked at Rhode Island Nurseries included *Acer palmatum, Myrica pensylvanica, Cornus kousa, Pinus thunbergiana, Fagus sylvatica* and *Viburnum carlesii*.

The final element essential to seed bed production is cost of production record keeping. This system should be closely monitored and annually reviewed. When cost figures indicate that seedlings may be purchased more economically from an outside source, management will have the necessary information upon which to base a decision.

Tube production. Recent controlled experiments with seedling production in Styroblocks or plastic tubes has proven very praticable. This method is particularly applicable to the grower who wishes to produce limited quantities of several species. Seedlings are removed from the blocks or tubes after one growing season and may be potted or bedded out for growing on. Cost of maintaining seed stands is reduced to a minimum by using this method.

Seed treatment. With the exception of *Taxus* seed, all seed is stored in a large cooler until required for planting. Temperature is controlled at a range of 34 to 40°F. Large seed lots are first mixed with clean sand and are stored in wooden boxes. Small lots of seed are mixed whith shredded sphagnum peat and stored in plastic bags. *Taxus* seed is usually received from an overseas source in mid-January. This cleaned seed is mixed with equal parts of clean sharp sand, placed in wooden boxes and stored outside in the elements for stratification. Seed received in the winter of 1978 will be planted in the fall of 1980.

Table of harvesting and seeding.

Fall harvest:
- *Acer palmatum* 'Atropurpureum'
- *Fagus sylvatica*
- *Cornus kousa*
- *Taxus cuspidata* (T. cuspidata 'Capitata')
- *Picea excelsa, P. pungens, P. glauca* 'Densata'
- *Cedrus deodora*

Fall seed
- *Acer palmatum* 'Atropurpureum'
- *Fagus sylvatica*
- *Cornus kousa*
- *Taxus cuspidata*
- *Myrica pensylvanica*
- *Viburnum carlesii*

Spring harvest:
- *Pinus thunbergiana*
- *Myrica pennsylvanica*
- *Viburnum carlesii*

Spring seed:
- *Picea excelsa, P. pungens, P. glauca* 'Densata'
- *Pinus strobus, P. mugo*
- *Cedrus deodora*
- *Taxus cuspidata*