

Post Healing Treatment. The easier cultivars (most of the *Juniperus scopulorum* cultivars) usually show callus in 7 to 14 days. Time for complete healing is variable, but in 6 to 8 weeks the callus starts to turn a dull brown color indicating the onset of lignification and formation of vascular connections. New growth from the scion preceded by a "spring" color change is also noticeable at this point. The hardening off procedure may then begin and should last 10 days to 2 weeks with gradual reduction of mist and increased hand watering. Constant random sampling is necessary to decide when to cut back the understock. This is done only after considerable lignification when the unions seem physically strong. We cut back the understock all at once rather than in steps because, quite frankly, we have seen no cultural advantages in the latter, more labor intensive method. The cut is made with a pair of sharp clippers at an angle in order to avoid a pronounced stub which might be subject to infection. In the same operation, the budding strips are removed and replaced with a thin piece of masking tape. The union is still tender and could be broken if handled too roughly. The cut back grafts are then reset in the beds and maintained on a water and fertilizer schedule until shipping time in mid-May.

FIELD PROPAGATION OF SEEDLINGS IN MIDDLE TENNESSEE

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Seed beds. The term "seed bed" implies the preparation and cultivation of seedlings en mass, closely spaced, and cultivated intensively in a confined area. This practice is not generally carried out in this region except under greenhouse or hothouse conditions in the propagation of evergreen liners. Most seed propagation in this area is, and has traditionally been, the row type of cultivation, which differs very little from the other types of nursery cultivation.

Seed sources. The seeds used for propagation of the liners and understock used in this area come from several sources. The wild collected seeds are the oaks, dogwoods, maples and many others. There are more plant species native to the McMinnville area than in the Great Smoky Mountains, which explains why the Tennessee nursery industry originated in this area. The seeds are harvested at the proper time of the year by people commonly known as "seed collectors." The collectors are usually older people who are capable of knowing the differ-

ent types of seeds, although this in no way insures a true-to-name seed bank. The next general seed type is the cultured or semi-cultured seeds. These include chestnuts, pears, and southern magnolia. The seeds may come from landscape trees or abandoned rows of stock. Peach and other specialty seeds are purchased from canneries as a byproduct or from other commercial sources. The peach seed will become understock for the budded fruiting peaches as well as the flowering peaches and plums.

Seed culture. There are several factors which play an important role in the variation of the culture methods for the seeds. The type and condition of the seeds determine the propagation measures; that is, the choice of type and slope of the soil in which they will be planted, the method of soil preparation, the depth of planting, the amount of compost covering for the seed, the correct fertilization program and the proper weed and pest control.

Land types used for seed propagation. Land used in the nursery industry in this area can be basically grouped by the length of time it has been cultivated. Land that has not been cultivated in the last 20 years is considered to be "new land." The new lands have traditionally been used for dogwood and this type of seed for several reasons. First, the crop can easily be grown while the ground is still heavy with roots; second, there are generally fewer weed and grass problems in these areas; and third, the new land is more friable and has a good organic makeup. The use of the new land is probably based on the fact that the leaf mulch contains natural bacteria and fungi that have a great influence on the growth and germination of these seeds. There are several of these fungi, molds, and bacteria now appearing on the market, but a tremendous amount of testing and experimentation will have to be done before they can become effective in the hands of the average nurserymen.

The established, or "old lands", that have been cultivated regularly or used for any crop growing or pasture are more compacted; however, they are of very good quality and more accessible and can be farmed with a minimum of difficulty. The established lands consist of sandy loams in the bottom lands, and from sandy to red clay on the hills. Excessive wetness in bottom land can result in seed decay and can preclude seed planting in these areas. The red hills are uniquely suited for peach and other fruit seeds. Tradition has it that the chemical composition of the red soil is best suited for these crops, and it will only take one year of field observation in this area to confirm the traditional belief. With the field tiller the nurserymen can pulverize the soil adequately so that plantings in recent years have worked well on established land.

Selection and preparation of seed land. Production pressure on the lands in this area are no different from those in any other. The necessity to produce, to pay taxes, and show a profit are as real as ever. Some lands are not available to be cleared for nursery use for several reasons. The underlying rock formations, which are usually limestone, tend to produce sinks that continually enlarge with time and make cultivation impossible. The size and number of rocks will, of course, be a factor as will also the degree of slope. These lands are usually left in timber production or pasture. After a suitable area is selected the bulldozer is the most efficient and economical way to begin the preparation for the planting. The initial work will remove the trees and large rocks. The direction of the push is the one with least resistance. The material is pushed in windrows, usually in the area where the greatest slope is located, in order to catch any runoff. This can be very important in some of the sandy soils. After the dozer is finished, an attempt is made to deal with the roots remaining. By use of a rooter, loose roots left by the dozer are carried to the windrows and those left remaining are removed by chopping with axes by hand. After the removal of the surface material, the land can be disced to raise enough soil for planting. The land cleared by these means will still be infested with stumps for several years, making future plowing difficult but not impossible. The dependable old mule is still used today in many instances.

The same factors apply for old land as new land. Degree of slope as well as rock formation are still important, but a more dominant consideration for established soils is fertility. What has previously been grown on the soil would determine the fertility. Once the selection has been made, there are two ways to prepare the soil for planting. The first, usually the easiest and most economical, is to spray with a good herbicide such as Roundup at the proper time for good kill. The time and amount of spray will vary with the type of weeds. Second, one can continue to work the soil during the summer months for weed control, but usually the cost is greater than for spraying. In addition, cultivation takes man-hours that can be applied where needed in other jobs. With the new herbicides on the market and with new land being difficult to obtain, more seedlings will be grown in the future on established land.

Very little work has been done on the effect of herbicides on the planted seeds, therefore any information presented is not to be taken as a recommendation but as a report on the results of experimentation. The pre-emergent herbicide Enide, at 8 to 10 pounds per acre, has produced good results in our area with no damage to the emerging seedlings. As a control on established seedlings, a combination of 8 pounds Enide with 2

pounds Simazine gives good results. More research must be completed before adequate safeguards will be available for nurserymen.

Seed placement. Before the seeds are planted each cultivar has to be treated in a different way, either mechanically or by natural ways. Heat from a roof, covering with sand for a number of days, or even treatment with acid can be used to increase productivity and decrease the number of days required for germination.

After the discing, furrows are made at different levels, again depending on the cultivar, by mechanical means or by hand. All seeds in our operation are sown by hand. The placement of the seed in the rows is dependent on the type or cultivar of seed. The larger seed, such as black walnut and different acorns or chestnuts, are generally placed one to two inches apart down the furrow of the laid off row. The smaller seeds, such as white dogwood, are poured into the row in large numbers. The smaller the seed, the more can be placed in the row and still have a well defined row. An ill defined row will suffer great damage during cultivation in the growing season. After being placed in the rows, seed is covered either by dirt or sawdust. The determining factor as to covering depends on the strength of the seed. Many of the smaller seedlings do not have the physical strength to push through a large layer of dirt. The majority of these types of seeds are those that normally appear from a humus layer on the forest floor and are not adjusted to this transfer to the open field. Decomposed sawdust is placed over these types of seed to keep the covering medium friable through the winter.

Seed fertilization. The fertilization which precedes the planting of the seed is usually in the furrow. A plow is run through the furrow to mix the fertilizer with the soil to prevent chemical burning of the seed. Side application of fertilizer is done after planting the seed. The makeup of the fertilizer is generally similar to 10-10-10; however, the nitrogen level will vary depending on soil type.

We have now completed the basic steps taken in preparation and growing of seeds in field propagation. Some seedlings will be harvested at the end of one year's growth and some will extend on for three or possibly four years.

The crop will be maintained each year with herbicides, pesticides, mechanical cultivation and hand weeding. After the crop is dug, it will then be decided whether to put the field back in a seed crop or to use it for cutting-grown material. After several years' use the best soils with correct slope will even be used to grow shade trees for bare root or balled and burlap pur-

poses. We have found these procedures for seed propagation give us very good results.

OPEN-FIELD PROPAGATION OF JUNIPERS

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I appreciate the opportunity to be with you today to discuss the subject of outdoor propagation — open-field propagation — of hardwood juniper cuttings. The idea is not original with us, although it is original in the geographical area of our nursery. In the early 1920's, a firm known as D.E. and J.O. Kelly Nursery began propagating in this manner, and since that time, almost every nursery in the area has attempted it. Most have been fairly successful because it is a simple method. Now, not so many are doing it for two reasons: more people are using the more modern methods of propagation such as mist, and the lack of consumer demand for junipers seems to have slowed somewhat the need for propagation.

We are in the very center of North Alabama, Zone 7, where temperatures sometimes drop to zero, but ordinarily are not quite that cold. Overall we have a very moderate climate. We have a fraction over 50 inches of rainfall annually in normal years. Our soil is a heavy, red-clay type. I think all these factors are important in considering how we propagate because, really, we let Mother Nature do the worrying.

A list of cultivars that we are propagating in this manner will give you an idea of the range we can do. We root a wide range of junipers, beginning with the naturally-layering types, such as *Juniperus horizontalis* 'Glauca', *J. conferta*, and *J. horizontalis* 'Plumosa. Other cultivars include *J. chinensis* 'Pfitzeriana', *J. virginiana* 'Kosteria', *J. chinensis* 'Pfitzeriana Compacta' and *J. chinensis* 'Hetzii'. Several *Juniperus communis* cultivars root well; some of these are *fastigata*, 'Hibernica', 'Ashfordii', 'Kiyonoi', and 'Suecica'.

There are certain cultivars for which this method of propagation is not successful, and one of the most obvious for us is the *J. chinensis* 'Pfitzeriana Aurea'.

Generally, our procedure is this: From vigorous, well-cared-for plants, we take cuttings of the current season's growth, approximately 8 to 10 inches long. The length varies with availability of the wood. The second cuttings would be just as easily rooted as the tip cuttings and sometimes root more easily. These cuttings are made in the field. In other words,