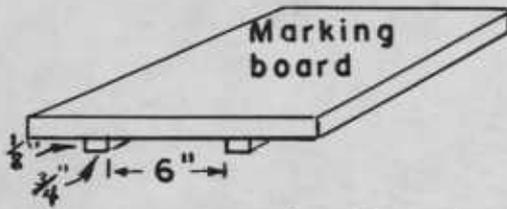
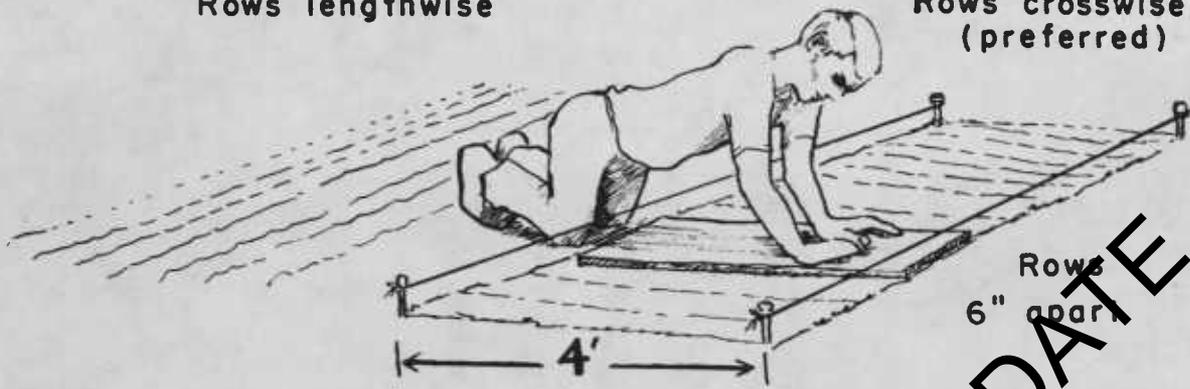


Rows lengthwise

Rows crosswise
(preferred)



Placed across bed and pressed
into soil

Finished marked rows
(Cross section)

ing are easier. Occasionally there may be a reason for sowing broadcast. Therefore, suggestions on this method also are given here.

As previously explained, the soil is worked well and leveled to provide uniform drainage to the sides. It then is raked smooth and pressed down gently with a board to provide a uniform surface for the seed.

Three-fourths of the seed is scattered evenly over the surface of the seedbed. The remainder of the seed is used to fill in the sparse places. The seed should be lightly pressed into the soil with a board, then covered in the manner described under "Sowing in Rows."

Watering and Shading

Water with a light spray to maintain a moderate moisture content on the surface and in the top foot of soil. (A water-breaker hose attachment that gives a soft spray is excellent for this purpose.) Avoid flooding so that the seed will not float away. Before and during germination, the soil must not be allowed to dry out during the day. This may mean watering more than once a day. Later, as seedlings develop, watering may not be needed as often. Prior to germination, watering may be done any time during the day. After germination, however, when the seedlings are still

tender, it is better to water during the morning and early afternoon. Then the soil will be dry by nightfall, and the chances of losses from "damping-off" fungi will be lessened. Stop watering after mid-August to allow the seedlings to harden-off before cold weather begins.

First-year seedlings require about 50 percent shade during hot weather. Use the type of shade frame already described. Shade is not needed the second year.

Damping-Off Danger

Watch carefully; the damping-off disease is likely to cause trouble. It causes the stems or roots of the seedlings to decay. (Some cautions have already been mentioned.) Treatments with acids, other chemicals, or fungicides are often used. Get advice from a nurseryman if damping-off persists.

Weeding

Weeds will smother the trees if they are not removed promptly. Also, if the weeds get as much as 1 inch tall, it is hard to pull them without injuring the root systems of the tiny trees. Large weeds should be cut off, but it is best to weed often so that large weeds will not develop. Planting trees in rows helps in weeding. The use of chemical weed killers is not recommended.

H. W. Chappell, Linn County, Oregon, grows Shasta and red firs for planting on his own lands. When in use, the roll-up shade frames are supported by the slim poles nailed to stakes.



Thinning and Root Pruning

If trees are to be grown to 2-0 stock (2 years old at time of planting), rows should be thinned to 20 to 25 seedlings per running foot before the second growing season begins. Early spring is the best time for thinning since the danger of additional seedling loss to freezing weather is past.

Seedlings should remain in the seedbed until adequate root systems are developed. If they are to be raised until they are 3 years old, which is ordinarily recommended for forest planting sites, the trees should be "root pruned" at the end of the first growing season after the plants are dormant. The best time to do this is in late fall when the soil is moist and soft but before winter rains have soaked it. If trees are being grown in an area where frost heaving occurs, root pruning should be done the following spring before new growth is started. With trees down in rows, root pruning can be done with a long thin-bladed knife or spade as shown in the diagram on page 9.

Place the blade in the soil midway between the rows at an angle which will make it possible to pry the roots off about 8 or 9 inches below the ground line. This pruning should be done on both sides of each row. The object of this procedure is to develop a spreading fibrous root system rather than a long spindly root which will be longer than the planting hole the tree is to be placed in later. During root pruning, try not to loosen the soil around

the tree roots any more than necessary. If the soil is loosened very much, it would be well to tamp it down along each side of the row when you are through pruning the roots.

If seedlings are to be transplanted to other beds, root pruning is done as part of that operation after the seedlings are lifted. Use a heavy knife on a board. Trim the roots of conifers to leave a root system only 4 or 5 inches long. Keep the roots moist at all times.

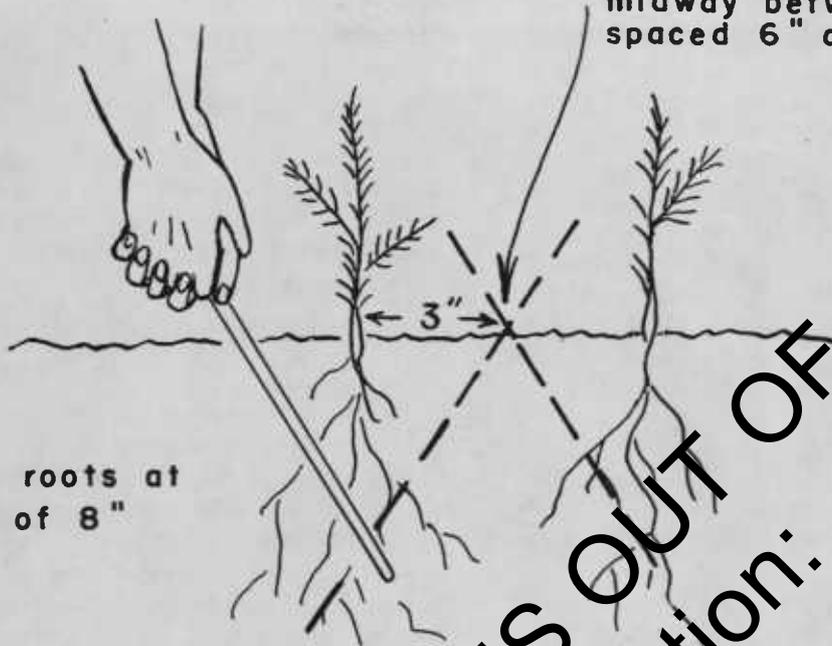
Mulching

During the first winter, it may be well to protect the young trees with a 3- or 4-inch layer of straw mulch free of weed seeds in order to prevent frost-heaving and damage. The straw should be removed as soon as the frost period has passed. Most Northwest forest nurseries prefer 1/2 inch of sawdust. It can be spread by hand and the fine sawdust can be brushed off the seedlings. If sawdust is used for mulch, it does not have to be removed (as is necessary with straw). Rodent-protective screens should remain on the beds.

Fertilizing

At the beginning of the second growing season, about April 1, apply a top-dressing of one-fourth of an ounce of 4-8-12 fertilizer per square foot. Repeat by applying another one-fourth of an ounce

Cuts are made here too.
Insert knife about 3"
from root collar, or
midway between rows
spaced 6" apart.



Prune roots at
depth of 8"

Root pruning can be done with long thin-bladed butcher knife if seedlings are in rows and the soil is soft. The job can be done with a sharp spade. The purpose is to develop compact root systems for better transplanting.

about June 15. *Do not burn the trees.* To avoid burning with fertilizer, apply it on a dry day when the seedlings are dry. After putting on the fertilizer, immediately sprinkle the trees with water to get all of the fertilizer off of the leaves.

Remember you are applying one-half ounce of fertilizer to one square foot to be divided into two applications of one-fourth ounce each.

Care the Second Year

During the second growing season, the beds again should be kept free of weeds but should not be watered except during extremely dry periods. In the first part of the second growing season, however, the soil should not be allowed to dry out to a depth of more than 3 or 4 inches. Shade should not be used during the second growing season.

Lifting and Handling

Coniferous trees generally are lifted for planting at the end of the second growing season. It is known now that Douglas-fir and ponderosa pine are in the best condition for lifting after the roots have become dormant. Research has shown that

this dormancy can occur from the middle of November in areas west of the Cascades. East of the Cascades, the same condition occurs in October. Therefore, wait until the trees are in a state of dormancy before lifting them. They can be lifted with an ordinary spade, but take care not to break the roots. If desired, bunch the trees for tying in bundles of 25 or 50. The nursery soil must be damp. Shake the excess soil gently from the roots and pack the trees in a suitable container, such as a bucket or a long, narrow box, with a wet material (like peat moss or shingletow) around the roots. Trees can be held in this manner for a short time, several hours or overnight. Roots should never be exposed or allowed to dry. Always allow free air circulation around the tops, and do not expose trees to sun or drying winds. Excessive handling between the nursery and the planting site will decrease survival.

Transplanting

Transplanting of nursery stock to other beds slows down top growth and stimulates root development. Nursery stock is sometimes transplanted, however, when it is desired to produce larger, sturdier trees with heavy root systems and

tougher stems for planting on adverse sites. While transplants are more costly, some planters will pay more for larger vigorous stock that will "surge" ahead when planted. Many areas require a sturdier tree to get adequate stocking in competition with grass and brush and to resist being bowed under by dead vegetation. Studies show that transplants have a 12 to 20 percent advantage.

Transplanting is done in the dormant season, usually in the fall or early spring. Beds are prepared in the same way as for seedbeds. Trees usually are spaced with a transplanting board. Douglas-fir often is spaced at 2-inch intervals in rows. Home-nursery operators who wish to use transplanting beds should get further information from forestry texts or forestry agencies.

Field Planting Suggestions

More trees will be grown if care is given to planting stock. Follow these precautions for a successful tree planting:

1. Do not break the roots when lifting young trees from the seedbed or transplant bed. Cut the

tops of broadleaf seedlings back to about 9 inches, and trim the roots back to about 10 inches for field planting. Trim off the roots on conifers to match the length of the blade of the hoe or other tool that will be used for planting, but not shorter than 8 inches.

2. Keep the roots moist all of the time.

3. Make the hole or slit in the ground large enough for the roots to take a natural spreading position. The ground line on the planted tree should be at the same place on the stem as it was in the nursery bed.

4. Place only moist soil next to the roots and press it down firmly.

If you are planting an area you cannot plow and work down, scalp a spot 18 by 24 inches for each tree. Plant the trees in the centers of these scalped places. This cuts down competition from weeds and grass. The young trees will stand a better chance of survival if they are placed on the north sides of stumps and fallen logs. Do not plant close to large brush clumps or trees.

Processing Tree Seed at Home

Collecting Cones

Many people who grow their own seedlings find it desirable to collect their own seed. They may want to obtain a supply of seed not available from dealers, to collect from a specific source or specimen, or to gather quantities that are too small for commercial dealers to handle. For more detailed information about cone collection, refer to

1. Dobbs, R. C., D. C. W. Edwards, I. Konishi, and D. Wallinger. 1976. Guideline to collecting cones of B.C. conifers. British Columbia Forest Service, Canadian Forestry Service Joint Report No. 3.
2. Douglass, B. S. 1969. Collecting forest seed cones in the Pacific Northwest. USDA Forest Service, PNW Region, Portland.

Seed Processing Equipment

Seed can be processed at home with readily available equipment. This includes a simple extractor or shaker box, a burlap bag, and a fan. For storage, it is necessary to have jars or plastic bags and a freezer. A bench dust brush and several rubber or plastic containers of one- or two-quart size will also be helpful.

A shaker can be made by replacing the bottom of any convenient-sized wooden box with hard-

ware cloth. Quarter-inch mesh will be satisfactory for some species, such as Douglas-fir. Large winged seeds, such as true firs, require 1/2- or 3/8-inch mesh. It will probably be most convenient to have boxes with various sized screens available. A hand-operated tumbler is better for large quantities of cones.

Precautions in Handling Seed

In order to grow good seedlings, it is as important to handle seed properly as it is to follow good practices in the seedbeds. Most conifer seeds can be easily damaged. This is especially true for the various true firs (*Abies*) because of their soft seed coats. Avoid practices that will cause cracking or severe abrasion, such as too vigorous stirring or rubbing.

Drying Cones

Cones can be air dried by spreading them out in single layers on a warm dry place. A concrete driveway or a well-ventilated shed can be used.



Basic steps in processing dried cones: First shake the cones in a box with a screened bottom; then roll or knead in a burlap bag to remove wings; then pour slowly in front of a fan to separate good seed from hollow seed and chaff.

After preliminary drying, the cones can be opened more completely by moving them to a warmer spot where the temperature will not exceed 100° F. Too high a temperature will kill the seed. A suitable spot is often found in the basement over the furnace or under hot air vents. Spread the cones in a single layer on screen racks and allow adequate air circulation.

Extracting Seed

After the cones have opened, seed is extracted by tumbling in the tumbler or shaking in the box. In the case of true fir, when the cones break apart, this extracting separates the seed from the cone scales. Additional screening with smaller sized screen will be helpful in removing debris such as cone parts and twigs.

Dewinging and Cleaning

Conifer seed should be dewinged after extraction. Dewinging and cleaning make it easier to handle and store the seed. Dewinging can be done by gently kneading the seed in a burlap bag. This process normally requires only a few minutes. Do not overdo the kneading or excessive abrasion of seed coats will occur. Cleaning is then done by winnowing or fanning. Slowly pour the seed from one container to another in front of a fan or outdoors in the wind. This operation will need to be

repeated several times. Fanning is not the most thorough way of cleaning seed, but it is satisfactory for small quantities.

Separating Hollow and Filled Seed

Although cleaning will have removed some of the hollow seed, quality can be improved by additional processing. Let the seed fall in a slow stream in front of the fan onto the table. The hollow seed will be blown the farthest away. Careful examination should then show the line between hollow and filled seed. Repeat the process several times to refine the quality of the seed.

Seed Storage

Conifer seed must be stored properly. Commercial dealers have stored Douglas-fir seed successfully for periods up to 10 years. Other species can also be stored for a number of years. The most successful method is to keep seed in airtight containers at a temperature of about 5° F. This can be done in the home freezer by putting the seed in airtight jars or plastic bags. For shorter periods of time, it is possible to store seed in a home refrigerator in an airtight container at a temperature of 40° F or lower. One of the most important points to remember in storing seed is to keep its moisture content low. This is accomplished easily by using airtight containers.

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