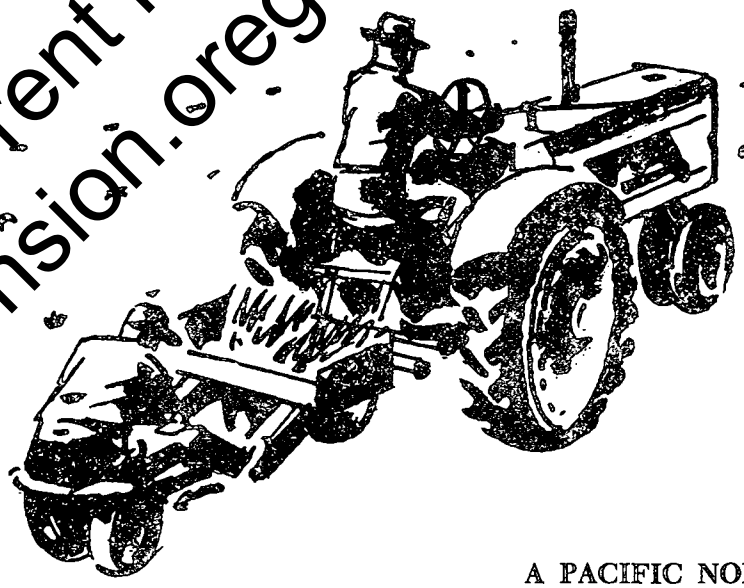
# Planting Forest Trees in the Pacific Northwest





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# *Planting Forest Trees in the Pacific Northwest*

Trees can be grown almost anywhere in the Pacific Northwest. Ease of establishment and rate of growth vary greatly, however, ranging from abundance of natural regeneration of fast-growing species in some areas, to laborious, high-cost planting of desert species that grow very slowly. The purpose of this bulletin is to enable the prospective planter to choose appropriate species and planting practices for his objectives and sites.

All recommendations for tree planting must be qualified by the generalization that plantations consist entirely of survivors of the planting effort, and that these survivors must bear the cost of the entire operation, including fixed costs. Insofar as is possible the principles that follow will support practices that establish trees suitable for forests or Christmas trees at the lowest possible cost per live tree or per unit of value at harvestable age. It is acknowledged that specific problems for which tree planting may be an answer may have values that differ from those assumed here, and in these cases the risk of plantation failure must be judged in different terms.

Drought is the most common cause of plantation failures in the Pacific Northwest. Long warm summers with extended drought periods are normal, even close to coastal areas. Suppression by brush and hardwoods is often a serious problem on cutover lands, and animal clipping and browsing can cause heavy mortality of planted seedlings almost anywhere. These problems may require professional evaluation.

## STEPS TO TAKE BEFORE PLANTING

*Ground preparation*

Trees, like other crops, need abundant moisture and soil of moderate fertility for optimum development. Rough fields, brush patches, and forests of cull hardwoods are poor chances for plantations without preparation, either before or after planting.

Old fields tend to dry out very early in the growing season. Open areas of this description are often operable with farm equipment, and may be fallowed readily during the summer or fall before planting. While such treatment is not absolutely necessary, in view of modern weed control techniques, less chemical will be needed after planting if soil is prepared first, and trees will have a more friable medium in which to root, and will develop faster.

Brushfields have the combined effect of depleting moisture, harboring rodents and browsing animals, and suppressing seedlings through shading and mechanical action of falling branches and twigs. Heavy stands of established brush of almost any species will tend to retard or eliminate conventional two-year-old nursery seedlings. Heavy brush may restrict access by planters, raising costs of planting, but planters can usually cover most of the ground at some irregular spacing without increasing the cost nearly as much as clearing. Chemical brush control is the most economical way to handle this problem. Because treatments in use today are temporary, one year of additional control is obtained if herbicides are applied after planting in the form of a selective spray when conifers are dormant. If the brushfield is too small to spray with aircraft, or if it is to be used for Christmas tree production where eradication is more important than simple control, it may be more desirable to clear the area with a bulldozer. Stumps and roots may then be treated with herbicides, if necessary.

Stands of cull hardwoods usually have considerable brush beneath the old trees. Since large hardwoods are difficult to kill with routine brush control measures, it is often necessary to kill them by injection or basal treatment. Treatment of the large hardwoods should be done during or immediately after the season of planting. Openings created by killing the hardwoods will permit seedlings to survive for several years, at which time selective brush control may be necessary to kill shrubby species.

Occasionally, site preparation is needed to break up heavy litter and humus. Freshly logged ground, particularly at higher elevations, may have a surface layer of organic material that is unsatisfactory for planting. Some degree of scarification is recommended if the depth of organic matter exceeds several inches, particularly on south slopes, so that most of the trees can be planted in mineral soil.

Other forms of site preparation, such as furrowing, ditching, scarification, etc., have been replaced largely by chemical weed control.

*Selection of planting stock*

Most tree species can be made to grow on areas suitable for forest growth in the northwest. Many will never do well, even once established, because of poor adaptation to climatic and soil conditions. Some species occur under a wide variety of conditions, and care should be taken when planting on of these to find stock suitable for a given planting zone.

Generally, adaptability of species may be evaluated according to water needs and cold tolerance. Of the trees

well adapted for forest plantings, the species should be selected from those of greatest value in local forests. Christmas tree species can include a wider selection, but poor adaptation to a site is likely to reduce quality. Species may be rated according to relative drought hardiness much more satisfactorily than for cold hardiness, but any ranking must be considered a very rough approximation. Recognizing these limitations, Table 1 gives an indication of relative drought and cold hardiness of coniferous species available from northwestern nurseries in quantity.

**Table 1. Ranking of conifers with regard to drought and cold hardiness.**

| | *Drought ranking* | *Cold ranking* | |
|---|---|---|---|
| Drought hardy | Ponderosa pine (Eastside) | Ponderosa pine (Eastside) | Cold hardy |
| | Ponderosa pine (Westside) | Lodgepole pine (Eastside) | |
| | Austrian pine | Austrian pine | |
| | Lodgepole pine (Eastside) | Norway spruce | |
| | Scots pine | Noble fir | |
| | Lodgepole pine (Westside) | Ponderosa pine (Westside) | |
| | White fir | White fir | |
| | Douglas-fir (Eastside) | Lodgepole pine (Westside) | |
| | Grand fir | Scots pine | |
| | Bishop pine | Douglas-fir (Eastside) | |
| | Monterey pine | Grand fir | |
| | Douglas-fir (Westside) | Douglas-fir (Westside) | |
| | Noble fir | Western hemlock | |
| | Norway spruce | Sierra redwood | |
| | Sitka spruce | Sitka spruce | |
| | Sierra redwood | Coast redwood | |
| | Western hemlock | Bishop pine | |
| Not hardy | Coast redwood | Monterey pine | Cold sensitive |

In all cases, timber species should be selected from available stock originating from stands growing under conditions comparable to those where planting is anticipated. Elevation is especially important in consideration of frost hardiness. East-west variations are important as well, with the summit of the Cascades corresponding to a sharp change in climate and characteristics of species that occur on both sides. Douglas-fir should be further specified as to coastal or Cascades origin; specification of a particular zone of origin may insure adaptability, when possible.

Selection of planting stock occasionally may involve considerations beyond simple designation of species and origin. Stock of different sizes is available, with generally higher prices for larger seedlings and transplants. Higher costs of large seedlings are justified where: 1) shorter rotations are desired, as with Christmas tree production; 2) brush resprouting may threaten to choke out small seedlings; 3) animal damage would retard small stock to the extent that brush would have an abnormal advantage. Large stock may be essential for any degree of success in either or both of the last two categories, and has the added advantage of reducing the need for repeated brush control treatments.

Hardwood species are used frequently for game habitat and windbreak plantings. Most of the species offered for these purposes are hardy in cold, dry areas. Selection may often be made solely on the basis of ultimate use. County agents can be helpful in selecting species adapted to certain objectives and site requirements. Hardwoods should not be planted near fields where herbicide drift from weed control operations will occur.

*Where to obtain seedlings*

Seedlings of most forest trees can be purchased from state nurseries in the Pacific Northwest at cost. They should be ordered in the fall regardless of the time they are to be planted. When an order is placed, arrangements should be made for delivery at a date just before time of planting. All farm foresters and county extension agents have order blanks. Orders can also be placed directly with the State Forester's office:

Department of Natural Resources
Webster State Forest Nursery
Route 4, Box 425-A
Olympia, Washington 98501

Forest Nursery
University of Idaho
College of Forestry
Moscow, Idaho 84843

D. L. Phipps Forest Nursery
State Forestry Department
Salem, Oregon 97310

There are also a number of privately operated forest nurseries. They may have certain species not available from public nurseries. Call your local County Extension agent, farm forester, or Extension forester at the state university for a list of private forest nurseries.

A few private nurseries in the region also can furnish a limited number of forest seedlings. At present most of them are specializing in Christmas tree stock or seedlings in special size classes.

*Storage of seedlings*

Seedlings provided by state and private nurseries are packed carefully, and may be stored for some time under favorable conditions. They will not keep well without watering and cooling, however, and it is desirable to open the bundles and place the seedlings in heel-in beds if they are to be kept more than a few days. Fully enclosed packages of seedlings may be stored up to two weeks at temperatures below 45°. Preferably, the seedlings should be planted as soon as conditions permit to reduce the time out of the ground to an absolute minimum. Freezing should be avoided, although good survival is occasionally obtained with stock that has been frozen thoroughly but thawed gradually.

## PLANTING THE TREES

*Season*

Seedlings should be transplanted when they are completely dormant, or at least when no bud activity is observable. The best season for planting at low elevations in the Pacific Northwest extends from December through mid-March. If favorable moisture conditions are antici-

pated, as with good site preparation and weed control or in coastal areas, this season may be extended into early April. Due to generally higher elevations, practically all spring planting in Idaho must be done between mid-March and early May. Whenever planting must be done early or late, seedlings should be planted as soon after lifting as possible, preferably within five days.

Considerations other than optimum condition of stock may influence time of planting. Higher elevations or severe frost conditions may require that seedlings be planted early or late in the winter. Early plantings are subject to frost heaving and extra exposure to animals and are not recommended where spring planting is possible.

*Methods and equipment*

There are a great many opinions as to advantages of certain methods of planting. Most of the differences are obscured if the ground is in satisfactory condition and if competitive grasses and brush are controlled. Methods recommended here have all been tried and proven, and will be discussed in order of increasing cost per live tree, with the lowest cost first.

*Machine planting* is recommended whenever equipment is available at reasonable cost, and where areas are large enough and clear enough to justify operation of mechanized equipment (Fig. 1). A crew of two with tractor and planter should be able to plant roughly 1,000 trees per hour on a sustained output basis or a labor cost of one cent per tree, based on $10.00 per hour for crew and equipment. Output may be somewhat lower for large stock, or in rough ground.

*Fig. 1. One type of planting machine in operation. Various designs are equipped to scalp a furrow. Relatively simple models may be made in a farm shop; all but the largest may be pulled with medium sized farm tractors. (U. S. Forest Service photo)*

*Bar planting* involves the use of a planting bar to open slits for placement of seedlings. This instrument has the greatest advantage over others when in the hands of a planter of sufficient weight to force the blade into the ground in one motion. The planting bar opens a relatively small hole, and is somewhat restrictive of seedling roots. This may not be a serious problem with two-year-old stock on weed-free sites, but can restrict root development badly when larger stock is used, or on droughty sites. Under ideal conditions, a worker can do a proper job of planting some 1,200 trees per 8-hour day; 800 trees per man-day can be planted under average conditions.

*Hoe planting* is done with any of a variety of planting tools roughly resembling the one illustrated (Fig. 2). The planting hoe, or hoedag, is used to open a large enough hole to accommodate the entire root system of the tree. This may be done in one stroke quickly in friable soil, or may require a small excavation. Under ideal conditions, one man can plant 600-1,000 trees per day.

*Fig. 2. Typical use of the planting hoe. This versatile tool is the most common in use for hand planting, and is especially suitable in rough terrain. (U. S. Forest Service photo)*

*Auger planting* is accomplished with a power-driven planting or post-hole auger, preferably with a bit four to six inches in diameter (Fig. 3). The planting hole is bored to a depth that will accommodate the whole root system. Auger planting has the disadvantage that a balanced crew needs at least two or three men to fill planting holes after boring. Moreover, it is often observed that scattering of soil may require extra effort to find enough soil to pack in the seedling. Under ideal conditions, a four-man crew may be able to equal the speed of hoedag users. Since depth of planting holes has little effect on rate of planting, this method is especially useful in open country where large stock with long roots is used.

*All methods*, including those not described here, have in common that seedlings must be packed in solidly, and that roots should be oriented downward. Proper depth of

*Fig. 3. Power auger planting. For each machine and operator, two or more planters must follow to keep up. This method is suitable for large stock in easy going, but is slow in rough or brushy areas. (U. S. Forest Service photos)*

planting should put the root collar at or barely below the ground surface. No matter what method is used, it is absolutely imperative that seedling roots be kept moist *continuously*. Appearance of dryness on roots at any time is extremely damaging, and may cause complete failure to produce new roots, hence death. Seedlings may be kept moist by covering with wet sacking, mud, peat moss, etc. If seedlings are carried in a bucket, they should not be immersed in water for more than a few hours at a time. On a wet day, exposure is not normally harmful if roots do not dry out.

No method will make trees survive on poorly drained soil, in heavy brush (Fig. 4), or in ground with heavy weed cover (Fig. 5). Conditions during the growing season in the soil and air immediately around the seedling may be much more important than any care in planting beyond reasonable adherance to the principles outlined above. Trees cannot survive severe drought, shade, or excessive

***Fig. 4. Trees planted in heavy brush and hardwood cover cannot be expected to survive without brush control. Killing brush will not guarantee survival unless protection from animals is provided.***

***Fig. 5. Sod is a severe competitor for planted seedlings. Grass effects are almost always harmful. Sodding is of little use, but does scarification give control for sufficient time. Chemicals appear to be the cheapest answer.***

water. Do not plan to plant where these conditions cannot be avoided. If weed control or drainage is planned to avoid these conditions, then treatments must be planned so that they are effective the *first* year the trees are in the ground.

*Spacing* depends upon planned use of the trees and the expected survival. Best spacing for Christmas trees is about 5 feet by 5 feet. For timber products a popular and economic spacing is about 11 feet by 11 feet. This latter spacing will allow survival roughly of 300 trees per acre if the loss is not greater than 15 percent. This will also allow thinning to remove the slower growing or deformed and diseased trees as they become large enough to sell. Low-density plantations give the lowest investment per dollar of return from planting, but at least 200 trees per acre are needed to utilize most sites in western Oregon and Washington. Individual trees grow faster at wider spacing. Benefits from spacing wider than 15 feet by 15 feet are limited by the ability of individual trees to occupy the ground much beyond their crowns.

The following table gives the number of trees per acre that would be needed from the nursery for different spacing distances:

| Spacing Between Trees | No. of Trees Per Acre |
|---|---|
| 5′ x 5′ | 1,740 |
| 6′ x 10′ | 720 |
| 8′ x 8′ | 680 |
| 10′ x 10′ | 430 |
| 11′ x 11′ | 360 |
| 12′ x 12′ | 300 |
| 15′ x 15′ | 200 |

Cost of planting each tree is about the same, regardless of spacing. Therefore, cost of planting one acre at close spacing (5 feet by 5 feet) is about four times the cost of planting 10 feet by 10 feet. However, more complete use is made of ground in the early years of growth by a closely spaced plantation. Ideally, small Christmas trees may be harvested early to start a succession of returns from thinnings of larger Christmas trees, followed in later years by posts, poles, pilings, and sawlogs. Combining Christmas trees with timber production involves the special considerations of both kinds of management, and is seldom practicable.

## CARE AFTER PLANTING

### *Moisture conservation*

Survival is the first requirement for a successful plantation. Most mortality occurs during the first summer after planting, and is directly the result of drought. Nearly all drought problems are avoidable; exact procedure will be determined by intensity of management and value of the final product.

*Chemical weed control.* Fallowing prior to planting will not provide adequate weed control to insure plantations success. Old fields and pastures with no prior site preparation especially need weed control after planting. Both situations may be treated with applications of selective chemical weed killers. New chemicals are developing continually, and Farm Foresters and County Agents keep current with recommendations. Recommendations given here include only atrazine, since this compound has been consistent, safe, and economical.

Atrazine should be applied at a time that will insure that spring rains will carry it into the surface soil, where it will be effective. One heavy rain is more effective than several lighter showers of equal total rainfall. One can never be absolutely sure that rains of any description will occur. A reasonable time would be on or about the date following which there is a 4:1 chance of having at least one rain of

one-half inch, or more. At Portland, Oregon, this occurs about March 25. At Medford, comparable conditions are reached one month earlier. In central and eastern Oregon and Washington, and in Idaho, there may be justification for spraying in late fall, simply to conserve all available moisture.

Rates of application for atrazine depend somewhat on climate, degree of prior site preparation, and vegetation. Most sites in western Oregon and Washington that have been fallowed prior to planting may be treated with four pounds per acre of 80 percent active product. Where no prior site preparation has been accomplished, the rate should be increased to five pounds per acre, or even six pounds where resistant perennial grasses like perennial ryegrass, California wild oat, and bentgrass are common. Broadleaf species resistant to atrazine include nearly all shrubs, Canada thistle, and wild carrot. Light treatment during the dormant season (March) with 2,4-D will provide control of some, but not all of the broadleaf species.

Chemicals may be applied with a wide variety of equipment. Properly calibrated ground rigs provide best results at minimum cost. Aerial application may require about 10 percent more chemical, but may be done at moderate to low cost with good results. Mist blowers put out such a volume of fine droplets that much herbicide drifts away, exposing neighbors to drift hazard and requiring substantially more chemical. Difficulty is experienced obtaining good coverage with all hand equipment.

Herbicides are usually applied broadcast. Atrazine is so selective that it can and should be applied directly over the entire plantation of conifers. Row treatments and spot sprays reduce competition on treated ground without damaging trees and are less costly than broadcast application. These methods have three strong disadvantages, however, that restrict their usefulness almost completely: 1) they leave heavy weed cover within range of competing roots, 2) they provide a tremendous seed and rhizome source for reinvasion of weeds for the second year, and 3) weed cover provides excellent cover for rodents. If it is necessary to use 2,4-D, apply in early spring; use only amine formulations if trees are to be used for Christmas trees. Do not apply more than one pound of 2,4-D per acre on pines, and never apply 2,4-D to any plantation during the growing season, except in extremely brushy areas where Christmas trees are not desired.

The proceedings of a Symposium on Vegetation Management in Forests, Ranges, and Noncrop Lands is an excellent general reference pertaining to uses of herbicides in forests. It may be purchased for nominal cost from the Oregon State University School of Forestry.

## COSTS

The cost of a plantation may be expressed as cost per harvestable tree, or cost per acre. Choice of planting procedures differ with method of figuring cost, but the value of a plantation must be considered in terms of harvestable trees or effective forest cover. Table 2 illustrates costs per acre and per live tree for various spacings and methods, with and without weed and brush control.

One may compare the cost per live tree as shown in Table 2 to help decide what site treatment is needed to

**Table 2. Plantation costs for different methods, spacings, and treatments; 1966 basis; 2-0 Douglas-firs seedlings.**

| Spacing & trees/acre | Method | Cost of trees Per tree | Cost of trees Per acre | Cost of planting[1] Per tree | Cost of planting[1] Per acre | Expected survival percent[2] No treatment | Weed or brush control | Site prep. and weed control | Total Cost[3] Per 100 live trees No treatment | Per 100 live trees 5#/A Atrazine | Per 100 live trees Disc & 4#/A Atrazine | Total Cost[3] Per Acre No treatment | Per Acre 5#/A Atrazine | Per Acre Disc & 4#/A Atrazine |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 x 5 | Machine | 1.2¢ | $20.88 | 1.00¢ | $17.40 | 10 | 70 | 95 | $22.00 | $ 4.37 | $ 3.43 | $38.28 | $53.28 | $56.78 |
| 1740/A | Bar | | | 2.25¢ | 39.10 | 10 | 70 | 95 | 34.47 | 6.16 | 4.74 | 59.98 | 74.98 | 78.48 |
| | Hoe | | | 3.00¢ | 52.20 | 20 | 80 | 95 | 21.00 | 6.33 | 5.54 | 73.08 | 88.08 | 91.58 |
| 6 x 6 | Machine | 1.2¢ | 10.52 | 1.00¢ | 12.10 | 10 | 70 | 95 | 22.00 | 4.91 | 3.92 | 26.62 | 41.62 | 45.12 |
| 1210/A | Bar | | | 2.25¢ | 27.22 | 10 | 70 | 95 | 34.49 | 6.70 | 5.24 | 41.74 | 56.74 | 60.24 |
| | Hoe | | | 3.00¢ | 36.30 | 20 | 80 | 95 | 21.00 | 6.80 | 6.03 | 50.82 | 65.82 | 69.32 |
| 6 x 10 | Machine | 1.2¢ | 8.71 | 1.00¢ | 7.26 | 10 | 70 | 95 | 22.00 | 6.10 | 5.00 | 15.97 | 30.97 | 34.47 |
| 726/A | Bar | | | 2.25¢ | 16.34 | 10 | 70 | 95 | 34.49 | 7.88 | 6.31 | 25.04 | 40.04 | 43.54 |
| | Hoe | | | 3.00¢ | 21.78 | 20 | 80 | 95 | 21.00 | 7.83 | 7.10 | 30.49 | 45.49 | 48.99 |
| 8 x 8 | Machine | 1.2¢ | 5.16 | 1.20¢ | 8.16 | 10 | 70 | 95 | 24.00 | 6.58 | 5.39 | 16.32 | 31.32 | 34.82 |
| 680/A | Bar | | | 2.25¢ | 15.30 | 10 | 70 | 95 | 34.49 | 8.08 | 6.50 | 23.46 | 38.46 | 41.96 |
| | Hoe | | | 3.00¢ | 20.40 | 20 | 80 | 95 | 21.00 | 8.01 | 7.28 | 28.56 | 43.56 | 47.06 |
| 10 x 10 | Machine | 1.2¢ | 5.16 | 3.00¢ | 5.59 | 10 | 70 | 95 | 25.00 | 8.55 | 7.15 | 10.75 | 25.75 | 29.25 |
| 430/A | Bar | | | 2.15¢ | 9.67 | 10 | 70 | 95 | 34.49 | 9.91 | 8.15 | 14.83 | 29.83 | 33.33 |
| | Hoe | | | 3.00¢ | 12.90 | 20 | 80 | 95 | 21.00 | 9.61 | 8.94 | 18.06 | 33.06 | 36.56 |
| 11 x 11 | Machine | 1.2¢ | 4.22 | 1.40¢ | 5.04 | 10 | 70 | 95 | 25.94 | 9.66 | 8.14 | 9.34 | 24.34 | 27.84 |
| 360/A | Bar | | | 2.50¢ | 9.00 | 10 | 70 | 95 | 37.00 | 11.24 | 9.30 | 13.32 | 28.32 | 31.82 |
| | Hoe | | | 3.25¢ | 11.70 | 20 | 80 | 95 | 22.25 | 10.77 | 10.09 | 16.02 | 31.02 | 34.52 |
| 12 x 12 | Machine | 1.2¢ | 3.62 | 1.40¢ | 4.21 | 10 | 70 | 95 | 26.10 | 10.82 | 9.17 | 7.83 | 22.83 | 26.33 |
| 302/A | Bar | | | 2.50¢ | 7.51 | 10 | 70 | 95 | 37.00 | 12.38 | 10.32 | 11.13 | 26.13 | 29.63 |
| | Hoe | | | 3.25¢ | 9.81 | 20 | 80 | 95 | 22.25 | 11.79 | 11.13 | 13.43 | 28.43 | 31.93 |
| 15 x 15 | Machine | 1.2¢ | 2.35 | 2.00¢ | 3.92 | 10 | 70 | 95 | 31.35 | 15.52 | 13.32 | 6.27 | 21.27 | 24.77 |
| 196/A | Bar | | | 3.00¢ | 5.88 | 10 | 70 | 95 | 41.15 | 16.96 | 14.37 | 8.23 | 23.23 | 26.73 |
| | Hoe | | | 4.00¢ | 7.82 | 20 | 80 | 95 | 26.08 | 16.03 | 15.41 | 10.17 | 25.17 | 28.67 |

1/ Assuming Labor @ $2.25/hr.

2/ Typical conditions Willamette Valley foothills, Eastern Oregon and Washington and Southwest Oregon

3/ Total costs are based on typical practices used for weed control and total site preparation on grasslands. No supervision or overhead is included.

complement the equipment that is available, or if all alternatives are possible. The cost for plantations of given spacings can then be calculated. It will be noted that the cost of success is indeed high if weed problems are severe, and that no choice of planting method is likely to help. On the other hand, if conditions are suitable for complete site treatment, success is less costly with the whole treatment for any method. Substantial savings are to be gained with planting machines under any conditions where they may be used. If ground does not lend itself to machine planting or mechanical site preparation, there will probably be no major difference in cost between hoe and bar plantings where survival is good. In many areas, expected survival will be intermediate between values listed in Table 2. Costs per acre will be close, however, and costs per live tree can be calculated from the number of survivors expected.

## CHECKING THE PLANTATION

Landowners who must contract planting jobs or hire planters need some basis for checking. Standard practices among public agencies involve spot checks of a given percentage of seedlings to insure that they are planted correctly. The main problems to be watched are loosely planted seedlings that are not in good contact with the soil, and seedlings planted shallow, or with roots badly turned up in a "J" form. Poorly planted trees have commonly resulted from machine planting when the machine used was not well adapted to the site, or when the ground was inadequately prepared. Good choice of a machine and proper site preparation measures offset the problems of poor planting within the limits that roots need to be at least six inches deep and not badly exposed to air pockets. Within reasonable adherance to this requirement, the main worry will be spacing.

Enforcement of plantation requirements does not depend on lengthy contracts. A simple statement in writing by the plantation owner should describe what is wanted, and should be signed by the planting contractor to indicate that he understands what he must do. A system of checking should be worked out by the owner and discussed with the planter before he signs his instructions.


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