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EC76-1741 Christmas Trees: A Management Guide

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Christmas Trees: a management guide

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Introduction

In America the decorated Christmas tree has become an accepted tradition. Christmas would seem barren to most people without it. Raising Christmas trees is a growing industry and has proven to be a profitable use of land if high-quality, salable trees are produced.

Planting, managing, and harvesting Christmas trees is a high labor, high risk endeavor. Here is a list of questions. If you can answer "yes" to **every one**, you will be a successful Christmas tree grower.



- Are you willing to plant trees every April?
- Are you willing to shear or prune every tree, every year (mid-June to mid-July) until it is harvested?
- Are you willing to control weeds and grass? Much of this can be accomplished with chemicals and cultivation, but manual work is required.
- Are you willing to devote time and energy in late November and December in marketing your trees?
- Are you willing to invest land, equipment, and labor to a project that will take at least six years before you see any return?

- Will you devote time to educate yourself in all areas of the Christmas tree business?
- Will you take the time to control or minimize the damage caused by mice, rabbits, moles, deer, and dogs?
- Will you protect the trees from fire?
- Will you completely exclude all livestock?
- Are you willing or able to accept periodic heavy losses due to drought, hail, or other natural causes?
- Do you enjoy tending trees as they grow?

Did you answer "yes" to all of the above questions? If so, read on. This circular will (1) help you make a decision before investment and (2) be a management guide for other Christmas tree growers.

Economic Returns

It is almost impossible to determine the exact dollar return per acre per year of a Christmas tree plantation. The cost of labor, land, equipment, number of trees planted per acre, tree survival, tree quality, local market conditions, type of marketing — all determine the economic return and each fluctuates widely.

As an example, let's make some assumptions and calculate costs and returns based upon the number of trees grown per acre. This method can be expanded to include any size tract of land.

Table 1. Six percent compound interest.				
<i>Years to the end of rotation eriod</i>	<i>If cost occur only in this year, multiply by factor below</i>		<i>If cost is a recurring constant cost from a given time period on, multiply by factor below</i>	
10		1.791		13.181
9		1.689		11.491
8		1.5938		9.8975
7		1.504		8.3938
6		1.419		6.985
5		1.3381		5.637
4		1.2625		4.375
3		1.191		3.184
2		1.1236		2.060
1		1.060		1.000

Let's assume the species is Scotch pine, to be planted at 6' x 6' spacing or 1210 trees/acre. Ten percent of the acre will be devoted to roads and lanes, so that only about 1,090 trees will actually be planted. Of these, another 10% probably will not reach maturity, and another 10% will not be salable. That reduces trees harvested to 883 and leaves 98 unsalable cull trees to be removed during the 8-year production period.

Land value is assumed to be \$1,000/acre. Management costs and taxes are \$30/acre, labor is hired at \$3/hr., interest rate is 6% (Table 1). Trees will be retailed at \$7 each. Follow these assumptions through the cost-

return table (Table 2).

Table 2. Cost-return, number of trees grown per acre.

Item	Basis	Years	6% Interest Factor ¹	Capitalized to the end of 8 years	
				Costs	Returns
Taxes & management	\$30/Yr.	8	9.8975	296.92	---
Land value	\$1000/A.	8	1.5938	1593.80	---
Planting stock	\$55/M x 1,090 = 59.59	8	1.5938	95.55	---
Planting cost	\$60/M x 1,090 = 65.40	8	1.5938	104.23	---
Weed control					
At planting	\$20/A.	8	1.5938	31.88	---
2nd yr.	\$20/A.	6	1.4190	28.38	---
3rd yr.	\$20/A.	5	1.3381	26.76	---
Mowing between rows	\$6/A.	8	9.8975	59.38	---
Pest control spray	\$15/Yr.	7	8.3938	125.91	---
Shearing, incl. basal pruning					
3rd yr.	4c/tree=\$39.24	5	1.3381	52.51	---
4th yr.	2c/tree=\$19.62	4	1.2625	24.77	---
5th yr.	2c/tree=\$19.62	3	1.1910	24.77	---
6th yr.	3c/tree=\$29.43	2	1.1236	33.07	---
7th yr.	3c/tree=\$29.43	1	1.0600	33.07	---
Trees sold, 7th year	$\frac{1}{2} = 490 \times \$7.00 =$ \$3430	1	1.0600	---	3635.80
Retaining Cost 7th year	$\$.85/\text{tree} \times 490 =$ \$416.50	2	1.1236	467.98	---
Shearing, 8th year	$4\text{c}/\text{tree} \times 490 =$ \$15.72			15.72	---
Trees sold, 8th year	$393 \times \$7.00 =$ \$2,751.00			---	2751.00
Retailing cost, 8th year	$\$.85/\text{tree} \times 393 =$ \$334.05	1	1.0600	354.09	---
Clean up cost - 98 cull trees	\$10			10.00	---
Residual land value	\$1000			1000.00	---
Total accumulated returns				---	7386.80
Total accumulated costs				3378.79	---
Net income for 1 crop in 8 years				---	4008.43
Avg. returns/tree	$(\$7,386.80 \div 883)$			---	8.36
Costs/tree	$(\$3,378.37 \div 883)$			3.83	---
Net income/tree	$(\$4,008.43 \div 883)$			---	4.53

Growing Christmas trees is a long-term investment. Planting trees for one or two years is not wise. A long-term yearly program is needed to make a Christmas tree plantation a paying proposition.

Industry Trends

Growers must be alert to market trends to more effectively control their numbers, kinds, sizes, and quality of trees. Some changes are long-term in development and, hence, predictable. Others, being short-term in nature, are harder to predict.

The steady increase in population brings more customers into the market each year. From 1930 to 1973 the number of U.S. citizens doubled. In 1930 one tree was purchased for every 14 people in the United States. In 1973 one tree was purchased for every three people.



Short-term trends frequently cause temporary impacts in the market. A good example occurred in the late 1940's when many buyers wanted long-needled pines. Later, there was an upsurge in the practice of using paints or flocking materials to artificially finish trees. More recently, large numbers of artificial trees have been sold.

An important and significant trend to the grower is the increase in number of trees being sold from plantations. Forty years ago 1 tree in 10 sold in Nebraska was plantation grown. In 1973, 9 out of 10 were plantation grown. Nebraska grown trees account for about 10% of the total Christmas trees sold in Nebraska.

The population is increasing. More people are buying trees. Most Christmas trees are grown in plantations. Everything indicates the future market for high quality Christmas trees is good.

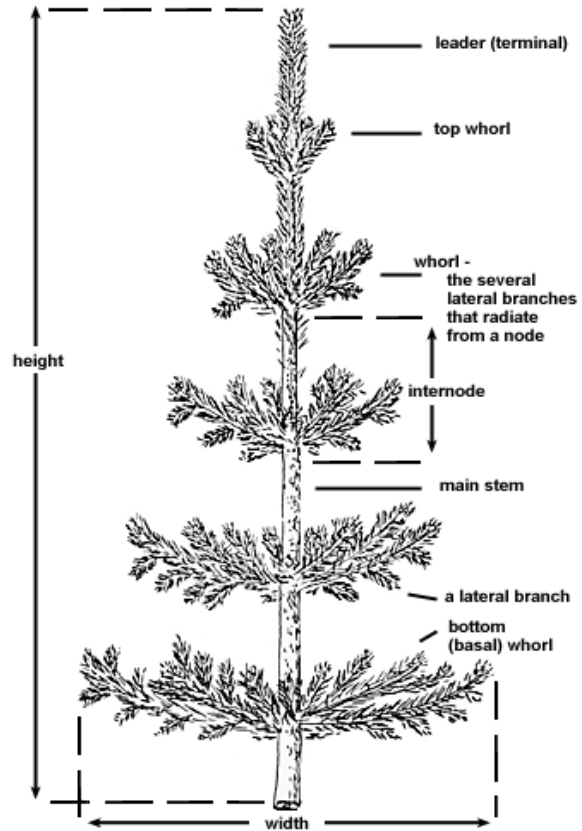
Characteristics of Good Christmas Trees

The successful grower must gear his operation toward quality production. To do this he must know the product he is trying to produce. The ideal characteristics of any species are:

- A single and straight main stem, including a well developed but not excessively long leader.
- A dense to moderately dense crown. Crown density refers to the compactness and amount of foliage present.
- A symmetrical crown that approaches a conical shape.
- The crown should be neither too broad nor too narrow in terms of height. "Taper" is a term used to describe the width of a tree relative to its height. Taper (in percent = width divided by height x 100. A taper of

40% to 90% for pines (40% to 70% for other species) is considered normal.

- The tree should have good overall balance. Balance is considered in terms of completeness or fullness on four quarters or sides and three segments of length.
- The bottom whorl of branches should be strong and regular and you should not be able to see large woody segments of the basal branches.
- The tree should have a handle long enough for mounting the tree to a holder.
- The tree should be fresh, healthy, and clean. "Fresh" needles are pliable and firmly attached. A "clean" tree is mostly free of undesirable foreign material.
- The tree should hold its needles throughout the Christmas season.
- A pleasing fragrance and cones also enhance a tree's attractiveness.



A tree grading system has been adopted by the Agricultural Marketing Service, U.S. Department of Agriculture. Many of the desirable characteristics listed above are involved in the minimum requirements for the three grades of marketable trees recognized under these standards (Table 3).

Some common terms used in discussing Christmas trees.

<i>Factor</i>	<i>U.S. Premium</i>	<i>U.S. Choice (or U.S. No. 1)</i>	<i>U.S. Standard (or U.S. No. 2)</i>
Crown density	Med. or better	Med. or better	Light or better
Taper	Normal	Normal	Candlestick or flaring
Undamaged faces ^b	All four	Three	Two adjacent
Foliage quality	Fresh, clean, healthy	Fresh, clean, healthy	Fresh, fairly clean, healthy

^aTrees are graded in part in terms of characteristics typical for the species. Trees of all grades should be well trimmed. When a lot of trees meet a specified grade, certain tolerances are allowed: By count, 10% may fail to meet requirements of the grade, but not more than 5% shall fail to meet the requirements of the next grade lower.

^b"Damage" actually refers to various described defects such as a decided gap (abnormal space between branch whorls), unduly long branches, uneven density, weak or broken branches, barren lower whorl, curved stem, an opening in the crown of considerable size, handle not proportionate to tree height, excessive leader length, multiple leaders and more than one main stem.

Species

Which kind of tree to grow is a difficult question to answer. Other, less obvious questions need to be answered first, such as:

- Does the public like this kind of Christmas tree?
- What races or strains of a species, if any, will yield trees that combine the desired traits of a conical symmetry, a fullness and balance of foliage, and good color?
- Can a given kind of tree be satisfactorily established in the area, and what kind of nursery stock should be used?
- Is the tree hardy under extremes of local climate?
- What kinds of soils are most favorable or unfavorable?
- What is the rate of growth?
- How does this kind of tree respond to various cultural practices?
- Are there any unusual problems of protection, including serious insect pests or diseases?

Testing and improving Christmas tree species is a long-term continuing project undertaken by private nurseries and the U.S. Forest Service.

Growers often plant several species. Customers differ in what appeals to them, such as a sudden desire for short- or long-needled trees. Also, the extensive planting of a single species increases vulnerability to insect or disease problems associated with one kind of tree.

Scotch pine (*Pinus sylvestries* L.) has earned a prominent place in the Nebraska Christmas tree industry. This popularity is not simply regional, for Scotch pine has edged out Douglas fir to become the most abundant species in national production. This reveals the impact of plantation-produced trees in the industry, for Scotch pine is not native to North America. Its natural range spans most of Europe and much of Siberia.

Scotch pine grows in a wide variety of soil types from clay to those predominantly sand. Avoid planting on wet sites. Plantings in areas from which top soil has been removed are usually successful.

Scotch pine usually requires five to seven growing seasons after planting to yield Christmas trees. Two-year-old seedlings (2-0 stock) or transplants, such as 2-1 stock, are satisfactory.

Eastern white pine (*Pinus strobus* L.) is a favorite ornamental tree over much of the East and Midwest. Despite its excellent symmetry, this species has received only limited acceptance nationally as a Christmas tree. Young seedlings of this species sunscald easily and are best established under some shade, such as moderate weed cover, or by planting older nursery stock. Test results show that the problem of low survival can be largely overcome by planting 2-1 stock rather than 2-0 seedlings. About six to eight years will be required to produce eastern white pine Christmas trees.

Douglas fir (*Pseudotsuga menziesii* var. *glauca* (Mirb.) Franco) has given fair results in deep, internally well-drained soils. High quality Christmas trees can be obtained in 8 to 12 years after planting 2-2 stock. This species is difficult to establish and hardy three-to four-year-old transplants or root-pruned seedlings are needed. Once established, Douglas fir has proven hardy under conditions of sustained drought, high atmospheric temperature, and other rigors of climate. Ridge tops and slopes where soils have a good internal drainage have been found most suitable. It is recommended that use of Douglas fir begin with small test plantings on untried but likely soil areas. Douglas fir makes a slow initial growth. Once height growth has

begun, the rate of growth is good.

Concolor fir (*Abies concolor* Lindl) has been successful with a few growers. It is very similar to Douglas fir in growth habit.

Austrian Pine (*Pinus nigra* L.) and ponderosa pine (*Pinus ponderosa* Laws) sell well as Christmas trees. Each is characterized by long needles, a symmetrical crown, and good winter color. One risk to the Christmas tree grower is that both the Austrian pine and ponderosa pine are subject to serious needle diseases. Austrian pine and ponderosa pine may have their needles severely killed back by *Dothistroma* needle blight. Both are subject to pine tip moth damage. Field plantings are made with 2-0 seedlings or, better, 2-1 transplants. Early growth is rather slow, and six to eight years are required to produce Christmas trees.

Spruces have the disadvantage of slow growth plus their needles hold poorly after cutting. Their advantages include good form and color retention.

Sources of Planting Stock

Christmas tree planting stock can be obtained from several sources. Many of the larger commercial tree nurseryies are located in the East, primarily in or around Pennsylvania. Names and addresses can be found in catalogs or in periodicals such as the *American Christmas Tree Grower's Journal* and the *American Nurserymen*. Planting stock also can be obtained from the Clarke-McNary program through the County Extension Office or Natural Resource District office.

Establishing a Plantation

Survival and vigor in tree plantings are determined by a combination of factors such as the suitability of the species to the planting site, quality of the planting stock, and climatic conditions. The planter cannot completely control all these factors but should be able to control some by considering certain establishment practices.

Rotation Considerations

Under proper management about the same number of trees should be planted every year. This allows for a yearly harvest. Under no circumstances should an entire area be planted in one year.

Example: You wish to use eight acres for Christmas tree production and plant 1,000 trees per acre. Rotation on pines is about eight years. You should plant one acre (1,000 trees) per year plus replanting any trees that did not survive the previous year. This allows for a constant yearly harvest of about the same number and size of tree.

Labor Limitations

One of the biggest mistakes a prospective grower makes is to **underestimate** the work required. Using the above example: The first year you will prepare ground and plant 1,000 trees (not a big chore), but by year nine you will be preparing ground and hand planting 1,200 trees, pruning or shearing 4,000 to 5,000 trees, and selling 800 to 1,000 trees. In addition, you will do some corrective pruning on 2,000 trees, control weeds/grass, and spray for some insects or diseases. The work load increases every year. Do not plant more trees than you can take care of properly.

Equipment Limitations

Equipment is not normally a critical problem with growers.

You must have machinery that can prepare ground, plant trees, mow, and spray. The main problem is when you have equipment wider than the spacing between trees. Example: You plan to mow with a 5-foot rotary mower, but trees are planted 5-feet apart. Rows should be at least 10 feet apart to use a 5-foot tractor-mounted rotary mower.



Rows should be at least 10 feet apart to use a 5-foot tractor-mounted rotary mower.

Market Limitations

Do not plant more trees than you can sell. It is easy to plant trees. The problem is you have only about three years in which to sell the same tree.

Outlets for selling trees are (1) choose-and-cut on an individual basis and (2) local wholesaling. Study your area. How many trees are sold and how much of this market can you attract? If the answer is 1,000 trees per year, don't plant 10,000.

Spacing

Trees differ in natural spread of crown and in the space they will occupy. Trees also require enough sunlight so that lower branches do not die. Spacings of 6' x 6' or greater are good for most Christmas tree species. Most growers prefer more spacing between rows so wider equipment such as cultivators, mowers, and sprayers can be used. Between row spacing of 11 feet is common. It is also important to include access roads at regular intervals.

Selecting a Planting Site

Site selection requires three basic considerations. The first is soil. Although some advantage is gained by planting on cooler east and north slopes, the importance of slope direction is outweighed by physical factors of the soil, such as depth and internal drainage. Shallow or rocky soils are too droughty. Claypan soils are typically winter-wet and often summer-dry, especially where the pan is less than two feet below the soil surface. Trees survive better, grow straighter, and withstand drought longer on deep soils that, because of good varietal drainage, provide aeration and deep moisture storage.

Plant on rich soils, but be prepared to control weeds and grasses. Upland slopes and ridges usually provide the best planting sites. Avoid planting on land subject to flooding. A Soil Conservation Service standard soil survey for your county, if available, can help you select your site.

Protection is the second consideration. Livestock must be kept out of the plantation. Browse and antler damage by deer will also harm the trees. Unless the plantation area can be closely guarded, roadside locations increase the likelihood of fire and theft. The stealing of trees for Christmas or for landscape plantings may become a serious problem for plantation owners.

Plantation location relative to the market is the third consideration. There is an advantage to being close to good market areas. Transportation costs are less and sales contracts are easier to make. Some growers near population centers build up a choose-and-cut or self-service retail trade at their plantations or operate retail lots in town. The suitability of land for Christmas tree production and the ability of the grower to produce those trees controls success more than does the distance to markets.

Site Preparation

Site preparation should be done a year ahead of tree planting. Clear the area of trees or shrubs. Leave no stumps that will

interfere with future operations. Reduce sprouting by plowing followed by disking. A deep and full plowing also speeds good root development of newly planted trees. This, in turn, speeds top growth of the trees. Good site preparation will make planting easier, increase survival, and stimulate early growth of the trees.

On many lands a rank growth of weeds and grasses follows plowing. The grower must be prepared to control weed and grass growth. Complete plowing can also encourage erosion — even on gentle slopes. This can be controlled by terracing and plowing alternate strips along contours, so spaced that planting can be done in the plowed soil. On highly erodible soils the use of Dowpon to destroy grass cover in preparation for planting may well be a better system of site preparation than plowing.

Care of Planting Stock

The quality of planting stock and the care given to it have much to do with a successful Christmas tree enterprise. Seedlings should be neither too spindly nor too large. When large seedlings are lifted from the nursery bed, too much of their root systems are often lost. The result is an imbalance between root and crown. Good planting stock has a well-developed root system within a planting depth of 8 to 10 inches. Large stock, with root systems up to 12 inches deep, can be easily planted with a good machine. A stocky stem is a better index of vigor than is height.

Transfer seedlings quickly and safely from the nursery bed to the field. Pick up bales of planting stock promptly at delivery points. Add cold water as needed to the bales and store temporarily in a cool, shaded location. If planting can't be completed within a few days, either put the bales in cold storage at 35° to 38°F or remove seedlings from the packing and firm their roots into trenches dug in moist soil. The latter operation is known as "heeling in." Never allow root systems to dry out or freeze.

Planting Trees

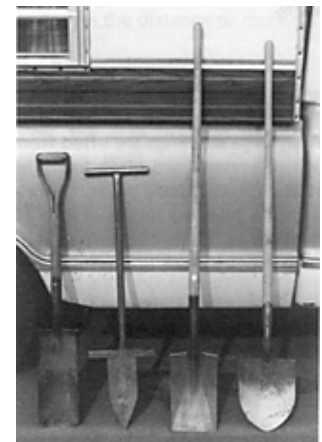
Plant trees in the spring. Mid-April to mid-May is the preferred time in Nebraska. Survival of newly planted trees depends more on soil moisture and general weather conditions than on planting date. Delaying planting a week or 10 days for better conditions is often justified. Planting trees when the soil is too wet to work is a mistake. The soil later cracks, air dries the roots, and the trees are lost.

A good planting job can be accomplished with planting bars, sharpshooter spades, and long-handled straight shanked shovels. Large seedlings may require hole planting, but the faster slit method is suitable for average-sized stock with root systems 8 to 10 inches deep. A slit of suitable depth is opened with the planting tool and the roots inserted. The soil is firmed around the roots by inserting the blade of the tool into the ground two to three inches behind the seedling. A backward pull on the handle will close the bottom of the slit around the seedling roots. Next, a forward push will close the top of the slit. When the tool is lifted, close the second opening with a kick of your heel.

More and more seedlings are being planted by machine. In heavy Nebraska soils, hand-planting rates range from 300 to 600 seedlings per man day. Two



Good site preparation will make planting easier, increase survival, and stimulate early growth of the trees.



Common hand planting tools (1) spade, (2) dibble bar, (3) square spade and (4) straight shanked shovel. (l to r)

men with a machine can plant as many as 8,000 trees in a day. Sometimes arrangements can be made through the local Natural Resource District to rent a planting machine.

It is advisable to walk behind the planter to check and improve the planted trees. Some seedlings may become covered with too much soil and others may need to be firmed up into a more upright position. It is very important to have the trees standing straight.

Machine planting usually produces straighter rows and better control of spacing between rows than does hand planting. These advantages will be appreciated when cultivating the soil or mowing the area after planting. Make all plantings on sloping land on the contour.

Weed Control

Keeping young Christmas trees free of excessive weed, grass, and woody plant growth is probably the biggest task in the initial stages of production. In planning your plantation, provisions must be made to control weed growth. This can be done by cultivation but an easier way is by using a preemergent herbicide applied in a 40-inch wide band to the tree row. Princep, a preemergence herbicide, has a good residual effect and a tendency to remain at or near the soil surface. The recommended rate for a heavy soil is 4 lb of active chemical per acre and for light soil, 2 lb of active chemical per acre. Weed control between rows can be accomplished by either cultivation or mowing.

Fertilization

Questions are often asked about the benefits of fertilizing Christmas tree plantations. Pines do not require high nutrient levels.

In most cases, pines planted on agriculturally poor lands in Nebraska can be expected to show little or no response to fertilizers (this does not apply to Douglas fir or the spruces, which have higher nutrient needs than the pines). Under most field conditions, the influences of the physical properties of the soil on such important factors as water uptake, internal drainage, root aeration, and moisture storage have more effect on plantation survival and growth than are any chemical supplements.

Nitrogen application can have a twofold effect. On newly established plantations, this element may prove indirectly harmful in that it will cause a luxuriant growth of grasses and weeds, choking out tree seedlings. Apply nitrogen only where good weed control can be maintained. In older plantations, where trees gained command of the planting site, nitrogen improved needle color. For winter-yellowing strains of trees this improvement was only temporary, and the needles underwent their characteristic discoloration in November and December.

Supplement a soil when soil tests indicate unusually low levels of nitrogen, phosphorus, and potassium. The percent of organic matter in the soil is commonly used as a rough index of available nitrogen. Two or three percent organic matter is usually considered adequate. Phosphorus and potassium are more likely to be too low. These elements should be raised to at least 50 ppm of P_2O_5 and 75 ppm of K.

Frequent soil tests are not necessary. Every 10 years or at the end of a crop rotation is sufficient.

Shaping for Quality Trees

Pruning, sometimes referred to as shearing or shaping, is an effective and necessary way of adding quality to Christmas trees. Most trees will enter the better grades only through such help.

Many trees differ drastically in growth and branching habit.

Because no two trees are alike, each tree must be studied individually and pruned as needed. Such decisions are quickly made by an experienced pruner. The beginner should proceed slowly. Speed must not be developed at the expense of quality.

Pruning vs. Shearing

Shearing is a process whereby trees are trimmed to shape without consideration of individual branches, as in the shaping of a hedge. Pruning involves the studied and selective removal or cutting back of individual branches in an effort to achieve a compact, symmetrical, and balanced crown while maintaining a natural appearance of the tree. This naturalness is important for it increases tree acceptance in the market.

Pruning and Shearing Tools

Small pruning shears of the anvil type, available in several sizes, are light and less fatiguing than most cutting tools. The ease with which they can be used in a wide range of pruning situations helps workers be more selective in the branches cut. The neat and natural effect obtainable with these small shears makes them a superior tool in the final shaping of trees for market.

Some workers use hedge shears. With either tool and a good worker, about 3,000 trees per man per day can be treated when the trees are round 3 feet tall. Pruning rate decreases with tree size. When heights range from 5 to 7 feet, the production rate of a worker may decline to 450 to 500 trees per day.

A skilled hand can successfully use a faster but cruder tool — the grass hook. To speed the pruning operation and yet maintain quality in the work, a two-step combination of tools may be used:

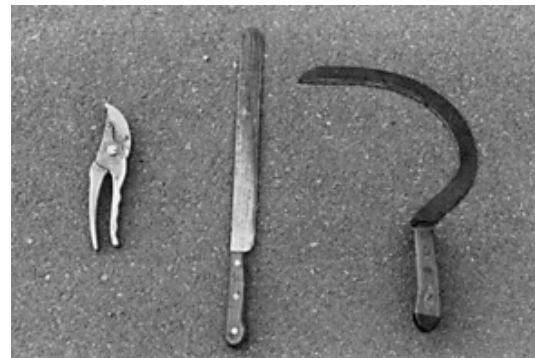
1. Use hand pruners to cut back leaders to the desired length of 10 to 12 inches. Then cut back lateral branches of the top whorl to balanced lengths of about six inches.
2. After Step 1 has been completed for the entire plantation, rewalk the rows with a grass hook, shaping the lower portion of the crown as needed. This can be accomplished with a rhythmed upswing of the hook while continually moving around the tree. It is especially important that the grass hook be very sharp and that precision be obtained in its use. Shearing in the year of harvest is necessary but must be done less severely than in other years.

Some growers use long machete-sized but thin knives developed especially for shearing to speed the job. The procedure for using the knife is similar to the grass hook. The only difference is the use of a downward swing with the knife. Although protective gear is worn when shearing with knives, danger to personnel is still high. Use of knives and other special shearing tools is subject to the same restrictions and precautions as described above for the grass hook.

Regardless of the kind of tool used, keep it sharp and oil any moving parts. Scrape resin accumulations from the tool's surface or remove with solvents such as turpentine or mineral spirits.

General Pruning Procedure

The four main objectives in pruning are:



Shearing and pruning tools (l to r) — (1) pruning clippers, (2) shearing knife and (3) grass hook.

1. To allow only one main stem and, therefore, only one leader;
2. To assure a compact crown;
3. To develop symmetry and balance in the crown; and
4. To locate and improve the base of the tree.

To achieve these objectives, most trees need some pruning each year, normally beginning when trees are about three feet tall.

If a tree is forked, remove all but the one best stem. This can be done early, before the tree is three feet tall, and is best done in late fall or winter when reserve energy in the tree is high. Cutting back of overly long leaders and general shaping work on pines must be done in late spring and early summer, depending on the species of pine. After the tree has one main stem, the rest of the work can be done systematically, proceeding from the top downward.

If there is more than one leader, remove all but the best one. Sometimes there will be no prospective leader that approaches the vertical. With pruning help, most of these trees will correct themselves. It is also possible to use commercially available wire trainers to force a straighter development.

If the selected leader is too long, cut it back to 10 to 12 inches using a slanted cutting angle. This prevents too much space between the strong whorls of branches along the stem. The correct leader length depends in part on the angle formed between the lateral branches and the stem. A strong upsweep of side branches will permit more leader length.

After determining leader length start pruning lateral growth. The top whorl of branches usually needs a strong treatment. Cut these new side branches back to lengths of about six inches or one-third of the terminal length to produce the desired taper. Following this same line of taper, continue into the lower part of the crown. Work down and around the tree, cutting back branches as needed to obtain a conelike shape.

Sometimes certain strong side branches persist in making excessive growth. These branches tend to force an unshapely crown, or, if numerous enough, will result in a flaring (excessively wide) tree. Correct this problem by pruning these overly strong branches forming that node. In Scotch pine, no pruning back to a node should be done on a tree during the two seasons before its harvest. Branches may be cut back to a node at any time of the year.

A good Christmas tree requires a strong whorl of branches at its base. Also, the tree needs a handle of about one inch for each foot of tree height, plus a little allowance for a fresh cut at the time the tree is put in the tree stand or holder.

Pruning around the bases of trees is often delayed until harvest. Some producers speed and improve their harvesting operation by locating their tree bases and cleaning tree handles as a routine part of pruning. As in removing more than one leader or in pruning branches back to nodes, the cleaning up of a tree's base can be done anytime during the year.

Pruning Pine Growth

To understand results from pruning pines, it is helpful to know that each of the bundles of needles is actually borne on a much-reduced dwarf shoot. These tiny and unseen shoots have the ability to form normal shoots, but this ability is usually lost with age. Activation of the dwarf shoots is triggered when the normal vegetative buds are removed by pruning tool, insect activity, or other cause.

Properly timed, cutting back a young pine branch can force development of dwarf shoots at or near the point of pruning. A bud will appear between the needles of each bundle in the area of the cut. Buds nearest the point of pruning will be the largest. Cutting the terminal diagonally at a 45° angle rather than straight across should encourage formation of one strong bud. This should reduce the number of large buds at a pruned tip, thus retarding the formation of multiple leaders.

Time of Pruning

Timing is critical in obtaining a good response to pruning. More and larger buds are formed if the treatment is applied during or near those days when young buds are being formed at the ends of new growth. The actual calendar date varies with species.

Austrian pine is usually pruned from late May to mid-June. Buds on Austrian pine apparently require more time to mature than do those on Scotch pine. Young Austrian pines tend to have less height growth than lateral growth. Lateral shortening is necessary in the first years, but height control is not as necessary.

Scotch pine is usually pruned from mid-June through July. If leaders are cut earlier, additional elongation of the leader will result. Multiple budding called birds nesting also may result. Pruning should begin when the new growth is still soft and succulent, after it has practically completed its elongation and before the new wood hardens. Pruning too late will result in few buds, slow growth, and dead stubs.

When properly shaped, white pines make high quality Christmas trees. Few tests have been made on shaping them and therefore an ideal time for pruning is not known. During the early growing season, white pine's response to shaping is similar to Scotch pine's response.

The shaping and shearing of spruce and fir can be done any time, but best results will be attained if the shearing is done when the tree is dormant. This would be any time from October 1 to April 1.

Whorl Spacing

Some growers recommend yearly cutting back of leaders to hold the distance between whorls to 8 to 12 inches. Others feel that as much as 20 inches distance can be allowed and still maintain a sufficiently dense crown. A between-whorl spacing of 12 inches is probably the most commonly recommended.

The angle of branching is probably the most important trait influencing the internodal distance. A tree's natural branching habit can vary from strongly upsweeping to wide-spreading. Trees whose laterals form sharp angles with the main stem can be allowed a considerably longer internodal distance than can those whose branching angle approaches 90°. Trees vary in their secondary branching. Some branch heavily and



Work down around the tree, cutting back branches as needed to obtain a conelike shape. (before - after)



The top whorl of branches needs a strong treatment. (before and after, l to r)

repeatedly and thus their branches close to form more compact crowns than do those with a light branching habit.

Final market size is also a consideration. Other variables being equal, longer internodal distances can be allowed with larger trees than with small trees.

Trees differ and people differ in their appraisal of trees. Some variation is desired in the characteristics displayed by a crop of Christmas trees. Pruning is an art directed toward the need for both quality and variety. Its refinement is developed through practice, observation of results, and more practice. A pruner must develop and maintain a sense of good tree balance and proportion.

Diseases, Pests and Other Problems

Diseases

Diseases can be an important factor in growing Christmas trees. Successful management requires the grower to be familiar with some of the more important diseases.

Brown spot infection on Scotch pine usually appears in late August. Infected needles will develop yellow spots which are often resin-soaked. The majority of the infected needles will be found on the lower branches of the tree, especially on the north side. Infected needles of all ages start dying from the tips back until the entire needle turns brown and falls off during October and November.

No natural controls are known for susceptible Scotch pine varieties. Applying fungicides at the proper time is essential. Fungicides must be applied before needle infection by the fungus spores. Apply first spray when needles are about half grown, usually about mid-June. If the infection is severe, apply a second spray three to four weeks later.

Two fungicides are currently recommended for use against brown spot on Scotch pine plantations — Bordeaux mixture and chlorothalonil (sold under such trade names as Bravo and Daconil). Both are registered for this purpose.

Dothistroma needle blight is found primarily on Austrian and ponderosa pines. The first symptom is yellow to tan spots that appear on infected one-, two- or three-year-old needles during the fall. These spots turn brown to reddish-brown. They are circular or slightly oblong and may develop into a band around the needle. The fungus grows within the tissues, killing the end portion of the needle while the base remains green. As the disease progresses, the base of the needle dies and the needle drops. Typically, clusters of needles upon a shoot are uniformly infected. Continued infection over a number of years can kill the tree.

Bordeaux mixture, either fresh or commercially prepared, provides an excellent control when applied twice during the growing season. Make the first application in mid-May, and the second in mid-June. The first spray protects the previous season's needles and the second spray protects developing needles. Bordeaux mixture is prepared at the rate of 4 lb of hydrated lime and 4 lb of copper sulfate mixed in 50 gallons of water. Satisfactory control is also obtained with other copper containing fungicides such as tribasic copper sulfate, cuprous oxide, and TC-90.

Pests

The Nantucket pine tip moth is a serious insect pest in Christmas tree plantations. The larva feeds on the buds and twigs of pines and may kill them or cause distortion of new shoots. Pines vary in their susceptibility to tip moth attack but Scotch pine, Austrian pine, and ponderosa pine are all susceptible.

The pine tip moth is difficult to eradicate because of its three generations per year. It can be held in check and damage minimized, by spraying branch tips in middle to late May with a 25% Dimethroate solution mixed at the rate of 3 pints to 100 gallons of water. Direct spray especially at the tips of branches in the tree tops, where most of the damage is done. Shearing also helps control this pest.

Spider mite is the name most often applied to a species of web-spinning mites. Trees are weakened by piercing and sucking activities of these pests. This injury is indicated by a dull and yellowish to bronze mottled discoloration of needles. Such damage is more likely to show up during periods of drought.

When shaken from infected branches onto a piece of white paper, mites can be seen as tiny moving dots. Observed under a hand lens, the adults are seen to have four pairs of legs.

Mites can be controlled with malathion, Kelthane, or Aramite at prescribed rates. Spray either from mid-May to early June or from mid-September to early October. Two sprayings with an interval of 7 to 10 days are sometimes needed.

With more plantings of Christmas tree species, it is to be expected that new and additional pest problems will develop. Growers should be alert to identify any new pest and obtain recommendations for its control.

Weather Damage

Weather injury is shown by dead tips of branches and twigs. In some instances the injury may kill the tree. Injury is most severe when low temperatures occur in very late spring after new growth is well advanced. Because of frost pockets, trees growing in hollows and valleys are damaged more often than those on higher ground.

Trees also suffer during the winter despite their dormant condition. Pine roots are most likely to freeze in poorly drained soils. The effect of frozen roots is seldom noticed until the following summer. At that time the tree may wilt and die. Root injury occurs most commonly during winters of little snowfall or in soils bare of vegetation.

Winter drying injury to evergreens is rarely caused by excessive cold during the winter. Water loss is reduced during winter months, but it may be considerably increased by warmth. Plants subjected to drying winds or growing in warm, sunny spots lose more water than trees that are protected. The drying damage is caused by excessive and rapid fluctuations in temperatures.

Certain precautions can be taken to reduce winter injury. Select well-drained soils. Trees will withstand low temperatures better in well-drained soils. Adding soil moisture in the late fall is advised if possible.

Long, dry periods can cause high seedling mortality the first season after planting. During these periods supplemental watering can mean the difference between high survival and almost complete loss.

Other Problems

Domestic livestock and wild animals can damage or kill trees. Livestock must be fenced out of Christmas tree plantations.

Rabbits and mice can damage young trees. Rodent damage usually occurs in areas of heavy grass cover which favors a buildup of these pests. Grass control is usually enough to solve this problem.

Fire can suddenly and completely destroy a Christmas tree plantation. Plans for the development of an area should take this into consideration. The establishment of a 15- to 20-foot firebreak around the plantation is wise.

Marketing Trees

Even with the best possible product, financial returns depend on the grower's selling ability. A grower should be familiar with United States standards for Christmas trees. A grower should be familiar with the market in the area where trees will be sold. The tree crop can then be better appraised in terms of the competition.

Most experienced growers do not try to sell their low-grade trees. Trees that do not satisfy market standards can be cut up and sold as boughs for wreaths, roping, and other Christmas decorations.

The local grower can retail or wholesale trees. Trees may be retailed, both at the plantation and at well located retail yards in town. Favorable yard locations, catchy advertising, a good display of trees, and satisfied customers contribute to selling success.

Direct wholesaling by the grower to retailers is another possibility. Trees are delivered at wholesale for about half their retail value. Grocery stores, organizations, and responsible individuals are examples of wholesale outlets. Marketing arrangements are normally made months in advance, regardless of methods employed.

A stable, satisfactory marketing process is developed over a period of years, during which time a relationship is built up between the grower and the buyers. An essential part of this business is sustained production of trees. Ideally, the entire planting area should be uniformly divided into planting units, sufficient in number to span the rotation period. For a seven-year rotation period for Scotch pine, the area can be divided into eight units. One unit is planted annually. The eighth unit provides the necessary time for final clearing and preparation of an area for replanting.

Not all trees of the same age reach their best Christmas tree potential in the same season. Any one planting is most profitably cut over a period of about three years. Scotch pine planted in year one would be expected to yield a first harvest for the Christmas season of year six, with additional cuts in year seven and year eight. The area would then be cleared for replanting.

Such a procedure in crop rotation will provide an abundance of Scotch pines in the size range of 3 to 9 feet. Heights of 5 to 7 feet are highest in demand.

Fire Resistance

An evergreen tree will hold its needles, stay in good condition longer in the house, and be reasonably resistant to fire if it is placed in a large capacity Christmas tree holder filled with water. The butt end of the tree stem should be cut off just before it is placed in the water.

A fresh cut Christmas tree will take up a pint or two of water every day for a week or more if set up in the home. Various chemicals have been suggested to make trees fireproof, but most of them change the appearance of the tree or reduce the absorption of water.

The Grower's Calendar

A Christmas tree grower has something to do every month of the year. Here is a monthly listing of important things to do and observations to make.

JANUARY

- Count replants needed.
- Order seedlings through your County Extension Office, your Natural Resource District, or a nursery.
- Summarize your sales records.
- Check for rodent damage in fields.

- Update your sales records, names, and addresses of retail customers, sales and records of wholesale customers.
- Best month for cutting sprouts, clearing fence rows and field corners and for cutting out brush.

FEBRUARY

- Check for rodent damage.
- Construct and clear fire breaks.
- Remove cull trees.
- Correct multiple leaders on previously unshered trees.
- Good time for butt pruning.
- Order herbicides and pesticides for the coming season (get professional advice before using. Order only a one year supply of chemicals).
- Finish up brush clearing and sprout removals.

MARCH

- Prepare planting beds.
- Get planting equipment ready.
- Apply preemergent herbicides around three-year-old pines (preemergent herbicides such as Simazine should be applied only one in either fall or spring, or apply 1/2 the full rate in the fall and 1/2 in the spring).
- Prepare income tax returns.

APRIL

- Plant trees.
- Get mower and cultivating equipment ready for summer.
- Complete preemergent herbicide applications.
- Look for peak emergence of Nantucket Pine Tip Moth and spray recommended insecticide 10 to 14 days later.

MAY

- Cultivate or mow around trees except where herbicide was used.
- As needle growth begins, spray recommended fungicide for control of tip blight, needle blight, and brown spot.
- Locate labor for shearing crews.

JUNE

- Shear Christmas trees.
- Check seedling survival.
- Look for peak emergence of second generation of Nantucket pine tip moth in late June and spray with recommended insecticide 10 to 14 days later.
- Spray recommended fungicide to control brown spot when needles are half extended.
- Cultivate or mow around trees if herbicides were not used.
- Maintain fire breaks.

JULY

- Spray recommended insecticide for Nantucket pine tip moth early in month after June emergence.
- Cultivate or mow around trees if herbicides were not used.
- Maintain fire breaks.
- Complete shearing of trees early.
- Contact wholesale buyers.

AUGUST

- Look for peak emergence of Nantucket Pine tip moth in early August and spray recommended insecticide from 10 to 14 days later.
- Cultivate or mow around trees except where herbicide was used.
- Maintain fire breaks.
- Order sales tags for retail trees.
- Make preliminary count of marketable trees.

SEPTEMBER

- Look for brown spot.
- Cultivate or mow around trees except where herbicide was used.

- Get final reports on wholesale orders.
- Place final orders for decorative supplies.

OCTOBER

- Find lot in town for retailing trees.
- Check your liability insurance, especially in choose-and-cut operations.
- Measure and tag trees for retail sale.
- Begin advertising, check signs.
- Apply preemergent herbicide around three-year-old trees.
- Protect young trees from rodents.
- Check and renovate harvesting equipment, including signs and equipment for choose-and-cut.
- Complete wholesale orders.
- Complete mowing on all trees, but especially seedlings.

NOVEMBER

- ADVERTISE
- Send reminder cards to prospective choose-and-cut buyers.
- Measure and tag merchantable trees.
- Check sales tax requirements.
- Apply preemergent herbicide around three-year-old trees.
- Protect young trees from rodents.
- Ball live trees for these sales.
- Harvest and ship wholesale orders.
- Make wreaths and decorative items for wholesale orders.

DECEMBER

- SELL — SELL — SELL
- Advertise.
- Make wreaths and greens from cull trees.
- Watch for trespassers.
- Open for choose-and-cut sales.
- Keep accurate sales and tax records.
- Relax for a well earned Christmas holiday.

EC1741



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.



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