

Master Copy Revisions

Christmas Tree Farming with Monterey Pines

**in NORTHERN
SAN JOAQUIN VALLEY**



Cooperative Extension
University of California

Adapted from

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INTRODUCTION

Monterey pine, Pinus radiata, is the most important Christmas tree species grown in the San Joaquin Valley. This fast growing, dark green, long needled pine has been widely accepted by both the public and the growers. Other species such as Douglas fir and Scotch pine are also grown for Christmas trees, but in fewer numbers (see Leaflet 21371).

This type of farming is economically feasible only as a long-term project. With good growing conditions, 3 years are needed before the trees are ready for sale. A few trees may achieve salable size within 2 years, others may require 4. Only part of a plantation is of salable size each year. Consequently, the cost of establishing and maintaining the operation will not be recovered until after two or three selling seasons.

This publication is concerned with the production of Monterey pines for on-the-farm sale of Christmas trees. It describes what is needed to get into this type of farming, how much time and what is required for the trees to grow in California.

Over the years, growers have found that buyers are interested in the following characteristics of Christmas tree farms:

- * A location that is close to their home.
- * Has some natural beauty.
- * Provides a challenging and enjoyable experience with meaning and tradition for the entire family.
- * Provides a fresh, high quality, well-shaped tree with dark green color, fragrance and dense foliage to contribute to the Christmas spirit.
- * Has a friendly and cheerful reception and an efficient operation without delays.
- * Prices in line with retail Christmas tree lots.

SITE SELECTION AND PREPARATION

A Christmas tree farm is a working farm eleven months of the year and a retail sales outlet the other month. While selecting a site, consider that the success of the farm depends upon the proximity of a population center, a soil able to produce trees you wish to sell and water. Look for land that is not too steep or rough, with a well drained soil. Heavy clay soils won't do as well for pines. Avoid land with major pest problems, such as bermudagrass, morning-glory, oak root fungus, etc. Again, check on the availability of irrigation water. To serve your customers ideally, the farm should be visible from a main road, easily accessible and have enough parking space for peak sale periods.

Not all these conditions are easily met. Hidden farms can be disclosed by signs and advertising, slopes may be reached by access roads, water may be piped in and most weeds can be controlled, but it is better to avoid such problem areas. They should be considered only as a last resort and only if customer potential is great.

Important: The prospective farm site must be zoned for agriculture and retail sales. Check this matter with your respective city or county. Variances from zoning laws are often time consuming and sometimes unattainable.

The cost of site preparation must be considered when selecting the site. If the area is wooded, expenses will be much greater than for land previously used for agriculture. Good virgin soils usually only require cleaning up of brush, rock and debris, and ripping of subsoil. Both tops and roots of brush should be removed and destroyed to prevent regrowth and fire hazards.

Depending on the amount of native vegetation and soil profile, it may only be necessary to disc under and plant the trees. Ripping is beneficial, in most cases, when bringing new ground into agriculture. Land used for field crops should also be ripped or subsoiled to obtain a deeper rooting area and better water penetration. Ripping should be done when the soil is as dry as possible to better fracture the soil. Clay soils that are hard throughout gain no permanent benefit from ripping and should be avoided as a plantation site.

Perennial weeds such as bermudagrass, nutsedge, bindweed and others must be eliminated before planting young trees. Areas with an excess of perennial weeds should be avoided because perennial weeds are costly to eliminate. If everything else about the site is right, a commercial fumigation is in order for control.

Rolling land is no problem if you plan to use sprinkler, drip or trickle irrigation. With these systems, terraces are not needed. Farms can be set on the square disregarding the slope of the land. On steep, rolling lands, pressure and flow regulation will have to be built into the irrigation system. Equipment for this purpose can be purchased from irrigation supply companies. Furrow or basin irrigation should be used only on level land.

FARM LAYOUT

Efficient handling of a large number of people in their automobiles is a key factor in marketing Christmas trees. A plan of the farm should be designed before installing the irrigation system and planting the trees. It should show traffic flow, parking lots and sale facilities. The

planting areas should be planned to coordinate with the marketing area. The sale area might be located in the center of the farm rather than at the exit.

After cutting a tree, how far will customers be willing to carry it? Monterey pines are heavy. Walking distance is not only a matter of convenience but of time. Getting customers in and out rapidly eases the parking problem. Trees located a long distance from parking areas are less likely to be sold. Large farms sometimes use farm vehicles to transport people and trees. Access roads around and through plantings facilitate cultural operations and establish the flow of traffic. Visit several Christmas tree farms and see how each has been planned before launching your own. Remember once the trees are planted, it is difficult to change the farm layout without sacrificing trees and without making changes in the irrigation system and other facilities.

EQUIPMENT

The ownership of large and expensive equipment is not necessary for the operation of most Christmas tree plantations. Heavy equipment used for site preparation may be rented or the work may be contracted to professional farm equipment operators.

Insect and mite pests are serious problems. These pests can cause defoliation and discoloration. They require occasional control by chemical spraying.

SPRAYING EQUIPMENT

The most practical manner of spraying larger trees is by walking between rows using a long hose from a power sprayer. For this purpose, access roads should not be too far

apart. A hose of a length equal to a little over half the distance between access roads is needed to spray from each side to the middle of the block.

A small garden tractor may be useful to pull a small power sprayer, or to haul equipment and supplies. These small tractors can also be used to till under weeds. The normal close spacing of Christmas trees makes the use of large equipment impractical.

A sprayer should be small enough to move between trees without injuring them. Hand sprayers or backpack-type sprayers are often used to apply pesticides.

Granular pesticides and fertilizers can be easily measured and applied with a hand broadcaster.

TREE SHAPING EQUIPMENT

The type of approach to shaping Monterey pines and the size of the plantation will dictate the kind of equipment needed.

- * Power equipment -- gasoline power generator to produce electricity for electric shears. This kind of equipment is used on large plantations where shearing is done to shape trees. The generator should be large enough to supply power for at least two electric shears and small enough to be pulled between tree rows. The electric cord ought to be long enough to reach across several rows. Gasoline engine powered shears are also available.
- * Shearing machetes or knives used with protective leg guards can be used to shape trees.

- * Long-handled hedge shears can also be used in shaping trees. This tool is safer for the worker to use than the machete or shearing knife.

- * Hand pruning clippers are used extensively. Some growers do all their pruning with hand clippers, while those with shearing tools use clippers to do leader and top whorl pruning.

PLANTING TOOLS

- * Long-handled shovels are used for planting container trees and seedlings. Shovels are indispensable tools on a plantation; no plantation should be without at least two.

- * Planting bars, special planting hoes and mattocks exclusively used for planting seedlings, planting trays.

- * Augers.

TOOLS FOR GENERAL USE

- * Large-flanged tooth-type hand-saws for rapid cutting are needed for cutting trees at time of sale. Very few growers use chain saws.

- * Fertilizer spreaders - a hand-held, cyclone-type fertilizer spreader is useful. A hand-pushed, wheel-type fertilizer spreader does not operate easily if the ground is rough.

- * Hand tools -- a must on any plantation. Pipe wrenches, pliers, saws, hammers, hack-saws, etc,

- * Pipe fittings and an extra supply of sprinkler heads should be kept at all times.

- * Long-handled hoes are always needed for a follow-up on weeds that survived herbicide spraying.

PLANTING

Soil moisture is the most important consideration at the time of planting. If too dry, soil is difficult to work and roots of newly planted trees will dry out quickly. In addition, the extra time spent digging holes in a dry, hard soil raises the cost of planting. If too wet, the soil structure can be damaged and oxygen supply may be inadequate for planting roots. The soil should have just enough moisture to keep roots from drying out.

STOCK

There are three basic types of planting stock: bareroot seedlings, gallon containers and liners. The characteristics of each should be carefully evaluated before deciding which to plant.

Bareroot Seedlings. Generally cost 5 to 10 cents per seedling, are 8 to 12 months old, 6 to 16 inches high. They are easily and quickly planted and will grow to salable size in three to four years. Some losses can be expected with bareroots but can be limited by special care during planting. Bareroots are not in soil and dry very easily; dry roots mean dead trees. When shipped to growers, seedlings are either packed in plastic bags, in moist peat or sawdust. If kept moist and in a cool place, these seedlings can survive for several days in their packed condition but need to be planted as soon as possible. During transplanting, keep the roots covered with wet peat, sawdust, vermiculite or burlap sacks. A container with a mud

slurry works well also if trees are left in it no longer than an hour at a time.

Planting Method. Set the seedlings into moist soil; irrigate shortly after transplanting. Bare-root seedlings need more frequent light irrigations than other planting stock. Planting holes are dug with one of the various tools, so that one side of the hole is vertical. Seedling roots are placed against the vertical side, giving them straight alignment; the soil is pressed firmly against the roots until the hole is filled.

If some trees are left over or the transplant operation is forestalled, they can be preserved for a month or so by "healing in." This consists of covering the plant roots with soil in a slanted trench, located in a shaded area. Seedlings should not be bunched, and the trench must be deep enough to prevent root curling. Soil is packed over the roots, and the trench filled with water. Keep the soil in the trench moist.

Bareroot seedlings are planted only in winter. They are the standard planting stock used by most growers when establishing a farm.

Planting Tools for Bareroots. Long-handled shovels, planting bars, planting hoes, mattocks and planting trays. The planting tray or container is used to hold the seedlings in a moist medium. No special design is required.

One-Gallon Container Stock. This planting stock is 12 to 18 months old and from 12 to 24 inches high. It is also the most expensive. There should be virtually no losses. At first, gallon-can stock grow more rapidly than seedlings, but by sale time seedling trees tend to catch up. Gallon stock is particularly valuable for replacing

harvested trees. Its ability to compete with the established trees is far better than that of the bareroot seedlings.

Planting Method. Remove the tree from the container and examine for coiled root or rootbound conditions. If the trees are planted in a root-bound condition, the roots are slow to grow. It is easy to correct this condition at planting time. Pull out any coiled roots at the bottom of the mass and cut off with a machete or shearing knife. Roots coiled around the outside are cut through on one or two sides. Some growers, using a shovel, cut vertically along the mass of roots just after planting the tree. New growth will develop along the cut.

Dig the hole as deep as the container is tall. Place the tree in such a way that the soil line on the tree is level with the top of the soil in the field. Fill the space around the root ball with loose soil. To avoid air pockets, tamp the soil lightly around the ball. Form a basin around the tree, with a slope down to the ball of the tree. Water applied shortly after planting will move into the ball area and wet the roots.

Planting Tools for One-Gallon Container Trees. Long-handled shovels, power-driven posthole augers, augers driven by tractor power take-off.

Power-driven posthole auger -- this piece of equipment may be rented. Two men are required to operate it. This method of digging holes is very fast. In a wet soil with sufficient clay, the sides of the hole will be smooth and slightly compacted. This condition may tend to restrict lateral root growth, scar the sides to break this smooth layer.

Auger driven by tractor power take-off -- this method of digging holes is probably not much faster than a power-driven posthole auger. Smooth, compacted sides are also formed by this tool in wet clay soil. This equipment can only be used on the first planting when there is room to drive the tractor.

Liners. Liner stock is grown in small plastic, clay, peat or tarpaper pots, usually 1-1/2 inches square, 6 inches deep. The liners are 8- to 12-month-old seedlings and from 4 to 16 inches high, costing about 45 cents each. Liners are often root bound. This condition should definitely be corrected because the circling pattern of the roots is much smaller in circumference than that of gallon stock and will be more constrictive. Seedling trees grown in plastic or clay pots must be removed from the containers. Tarpaper and peat pots may not require removal, but most growers cut or tear the sides of these pots to permit better water movement into the root zone and allow the roots to grow out more readily. As with gallon stock, an advantage of liners is their ability to be planted at any time. There is no transplant shock. Mortality of liners is not as great as that of bareroots but is greater than that of gallon stock. A major use of liners is replacing bareroots that died. The time for liners to grow into salable trees is about the same as that of bareroot. The planting method is the same as that used for gallon stock, except that a much smaller hole is needed.

Irrigate these seedlings soon after planting. Small liner trees are susceptible to drying because of the limited amount of soil in the container.

Planting Tools for Liners. Long-handled shovels, mattocks, planting

hoes and planting trays. Removal of one shovelful of soil makes a hole big enough for planting liners. The planting hoe is driven into the ground and worked up and down to make a large enough hole for the liner. The mattock is used to remove just enough soil to provide space for the liner.

Cuttings. Another possibility worth investigating is the use of container stock grown from cuttings. Cuttings from superior trees offer great advantages in the rapid growth of trees of good form, eliminating growth variation from seed. Vegetative propagation was not widely used in the past because of the difficulty of rooting Monterey pine cuttings in contrast with the ease of growing from seed. Now, rooted cuttings are being produced quite successfully and the resulting trees are impressive.

STAKING

Staking is seldom necessary. Tamp the soil around the tree with your feet. Usually this is sufficient to hold it erect. After a few months in the ground, the trees can be straightened if needed and will stay reasonably erect. Leaning trees need to be straightened even after considerable growth. It is not unusual to see growers put a knee against a good-sized tree and bend it back vertical. Branches that grow too erect can be bent down to form a better shaped tree. Most crooked tops can also be realigned by bending. More severely bent tops generally need an in-tree splint, or need to be tied to a stake. Fortunately, Monterey pines are quite responsive to bending.

STUMP CULTURE

When a Monterey pine is cut, it is sometimes possible to grow a new top on the stump. This raises the

intriguing possibility of growing successive tops on the original stump. Since an extensive root system is already present, new top growth could be rapid and most of the replanting could be eliminated.

There is, however, more to it than that. Dormant buds in Monterey pine are only found in the base of needle buds. Some growth with needles must be left on the stump for a new shoot to start. In practice, several branches must be left on the stump or it usually dies. Regrowth is often chlorotic, further growth is slowed and the poor color detracts from the appearance of the stand. Later normal color returns, but the chlorosis often persists into the second year after cutting.

The shoot selected to make the new top must be staked to direct the growth as nearly upright as possible. Even so, stump cultured trees characteristically have a bow in the handle. The rather high crooked handle normally produced is not well accepted by customers.

Most growers prefer to replant a new tree alongside the stump.

STUMP REMOVAL

If a stump is left in the ground for 2 or 3 years, the roots normally rot away sufficiently so the stump can be removed with a few strokes of a sledge hammer.

Occasionally, fresh stumps are removed before replanting. Since the remaining trees are too close to maneuver heavy equipment, smaller equipment must be utilized. The time and effort required to hand dig fresh stumps discourage such a direct approach. A tripod standing 6 to 7 feet high and rigged with a hoist and logging tongs has been successfully used to remove stumps.

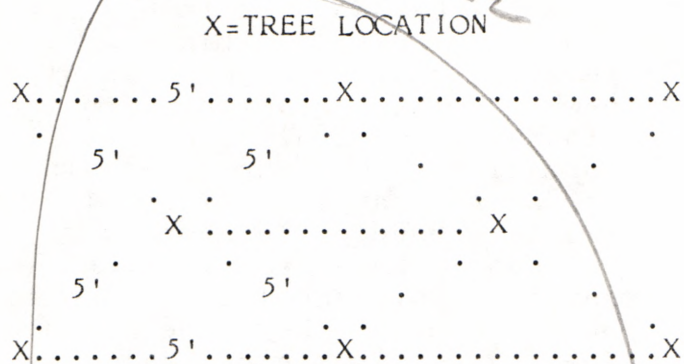
There is little advantage in removing stumps, and they are generally ignored. Although it is not necessary, cutting the stumps flush with the ground lends a neater appearance to the farm.

TREE SPACING

The choose-and-cut Christmas tree farms are generally located in suburban and urban areas because tree sales are best in or near population centers. Leasing in these areas is expensive, so intensive management is applied to derive the greatest possible production from the farm. The various cultural programs discussed in this publication need to be employed and efficient spacing program established. Too often, tree spacing is determined by the width of the grower's tractor or some other factor irrelevant to maximized production.

Most established farms have a 5- by 5-foot spacing. This 5- by 5-foot spacing allows 1742 trees per acre. When the trees are young, these spacings allow ample room for equipment. Five feet between rows provides customer walk areas when the trees are ready for harvest. At the end of each row, space should be allowed for turning equipment.

The maximum number of trees per acre is obtained by using a triangular spacing method rather than square spacing. By this method, approximately 15 percent more trees per acre can be planted with the same space between trees. The trees are not planted facing each other at a 90° angle as in the square method; they are planted on a diagonal, forming a triangle. This system is called the diagonal or offset spacing.



Once the spacing has been determined, the field is lined out according to that spacing. One method for lining out the spacing is to construct a template of metal or wood with the exact dimensions required. A template for the triangular 5- by 5-foot spacing would be a triangle with two sides 5 feet long, the other 4 feet.

Using the template to mark the trees' location with spray paint or colored powders, the field is then lined out.

The main consideration in selecting a spacing program is how much traffic space you are willing to sacrifice for a greater number of trees.

A study of tree growth in relation to spacing and planting pattern indicated that the farther apart trees were planted, the taller they were at time of sale. More total growth was obtained on closer spacing since there were more trees per row. No difference in tree growth was found between square and triangular plantings when trees were the same distance apart.

DEVELOPING THE CHRISTMAS TREE SHAPE

Pruning the Monterey pine to form a near-perfect, rather narrow-tapered conical shape can be the most important part of a farm operation. It can also be the most time consuming, frustrating and the

least understood of any of the cultural practices. There are four basic steps that lead to a successful pruning program:

1. Establishing a straight handle.
2. Establishing a main leader and basal whorl.
3. Controlling leader and top whorl growth.
4. Shaping side branches to desired taper.

A healthy, vigorous-growing Monterey pine responds very well to pruning. A cut made on either the leader or side branches results in numerous buds developing from the needle bundles nearest the cut, producing a new, bushy growth. During the active spring growing period, bud development occurs within a month after pruning. In more dormant periods, it may take two to three months for new buds to form. Unnecessary cutting increases the time needed to produce a marketable tree.

ESTABLISHING A STRAIGHT HANDLE

A handle is that portion of the tree extending from the ground level to the bottom row of branches (basal whorl). All trees should have a 6- to 8-inch handle to support the tree in the stand after it has been harvested. Due to prevailing winds or poor planting practices, a crooked handle may develop. Trees that are not upright should be straightened or some height will be lost when it is necessary to develop a handle on a straight portion of the stem. To straighten small trees, pull the tree upright and pack the soil on the leaning side. Many growers use a small 12-inch sledge hammer for this purpose.

BASAL WHORL AND LEADER DEVELOPMENT

The major objective during the early life of a tree is to obtain a basal whorl 10 to 12 inches above ground line. A whorl consists of 4 to 7 side branches growing at the same level in a circle around the main stem. Monterey pines often develop too long a main stem before side branches appear. It's difficult to predict at what stage side branches may appear. Force this whorl to develop by removing the growing tip of a young seedling at 12 inches if a well-formed whorl has not developed naturally (figures 10a and b). This may be

done with hand clippers or by finger pruning. Finger pruning removes only the very tip of the new growth, allowing continued elongation and forcing bud formation. Cutting the main stem at a 45o angle allows the top needle bundle to produce the dominant bud. This bud will develop into the leader with lower buds forming the side branches. The leader is the central stem or branch. Sometimes more than one leader develops; one must be selected as the main leader and the others removed, leaving only 4 to 7 side branches for the whorl and one leader that will become the main stem (figures 10c and d.)

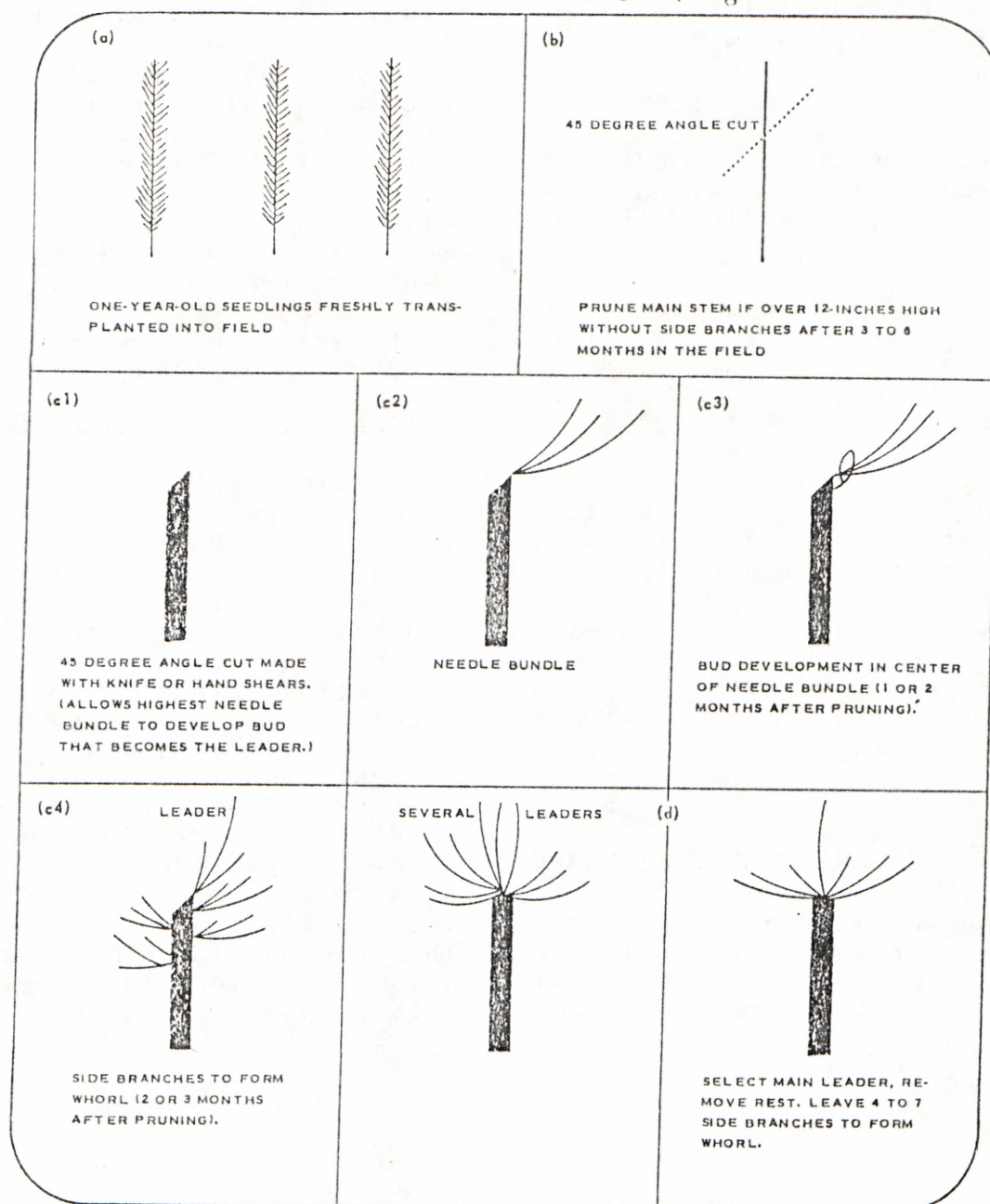


Figure 10a, b, c, and d. Establishing the first whorl and leader on Monterey pine.

Some trees grow over 18 inches tall without developing a whorl. To cut these trees back to 12 inches would mean a great loss of growth. Fairly good success has been achieved forcing a whorl by plucking needles 1 inch or 2 above the point where the whorl is wanted (10 to 12 inches). A mass of shoots will develop from the needle bundles just below this exposed area. This same technique can be used higher when wide spacing between whorls occurs. Branches developed this way have a late start in relation to older ones and will not get as large.

If the tree has reached a height greater than 12 inches and a well-formed whorl has developed naturally, the tree should be allowed to grow rather than be cut back reducing the overall growth. Growers using gallon container stock may request the nurseryman to establish the first whorl in the nursery. Bareroot stock usually always requires whorl development in the field.

The leader should have dominance over all side branches. When side branches have greater height than the leader, they should be cut or pruned to allow the leader to gain dominance. The cut of the side branch forces new bud development just as it does on the leader. These new buds form branches eventually, lending a full bushy appearance to the tree. As the tree grows, each successive whorl can be developed in the same manner as the basal whorl.

The goal at the end of the first growing season should be:

1. An upright tree with a straight handle.

2. A developed basal whorl with as many additional well-spaced whorls as possible.
3. An established center leader.
4. Maximum height growth.
5. Maximum width growth.
6. A healthy, vigorous-growing tree.

LEADER AND TOP WHORL DEVELOPMENT

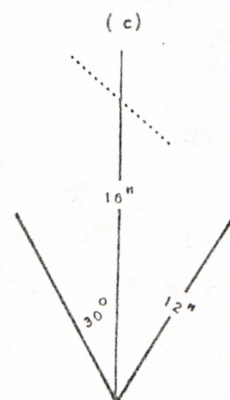
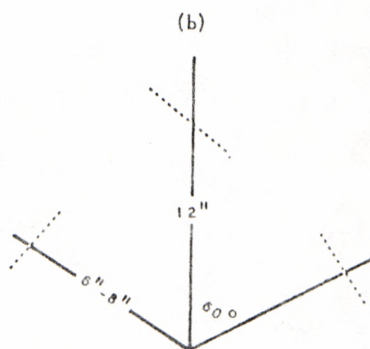
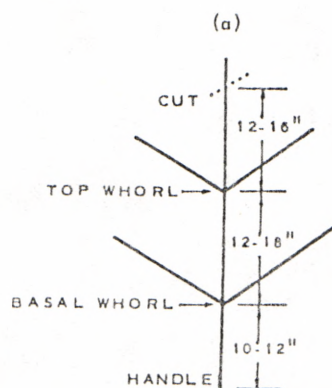
The purpose of leader control is to establish whorls when adequate branching does not occur. Leader control is critical. Extra long leaders produce open, low-quality trees because whorls are too far apart. Very short leaders increase the time it takes to market a tree. Ideal leader length occurs when the side branch growth covers the main stem and leaves no unattractive openings. Many growers do monthly leader control during the tree's active growing periods, walking through the plantation culling leaders with excessive growth.

As mentioned before, after the topping of leaders, many of the new developing shoots grow vertically. Encourage only one shoot to be the dominant leader by cutting the others, leaving the horizontal shoots to develop into side branches.

Top whorl branches must be cut when leaders are cut to keep them from gaining a dominant position. Cutting reduces weight at tips of branches, allowing a sharper branching angle and a bushy growth. When trees have a sharp branching angle, not only can the leader be longer, but side branches can be left at least three-fourths the length of the leader.

1. Use knife or hand shears to maintain leader length at 12 to 16 inches. Make a 45° angle cut as shown in figure 12a.
2. Prune top whorl branches at the same time as the leader, see figure 12b.
3. Trees producing branches with a sharp angle to the stem can be allowed longer leaders (figure 12c). Flat-angled branches should not have leaders longer than 12 inches the year the tree is to be sold.

Figure 12. a, b, c. Leader and top whorl pruning.



The grower's objective should be to hide the main stem from view. Reducing the length of the leader and top whorl usually does this. If it fails to change their length relationship, pruning may be only increasing the time it takes to produce a marketable tree. When leaders need to be cut, it is often necessary to cut only the growing point of the side branches; it slows the growth of these branches until the leader begins to grow again, but gives side branches adequate growth to cover the main stem. The greater the number of laterals and the harder the wood, the longer the branches can be before being cut. Branches cut short on hardwood produce more branching and, hence, denser growth than branches cut long on tender growth.

SHAPING SIDE BRANCHES

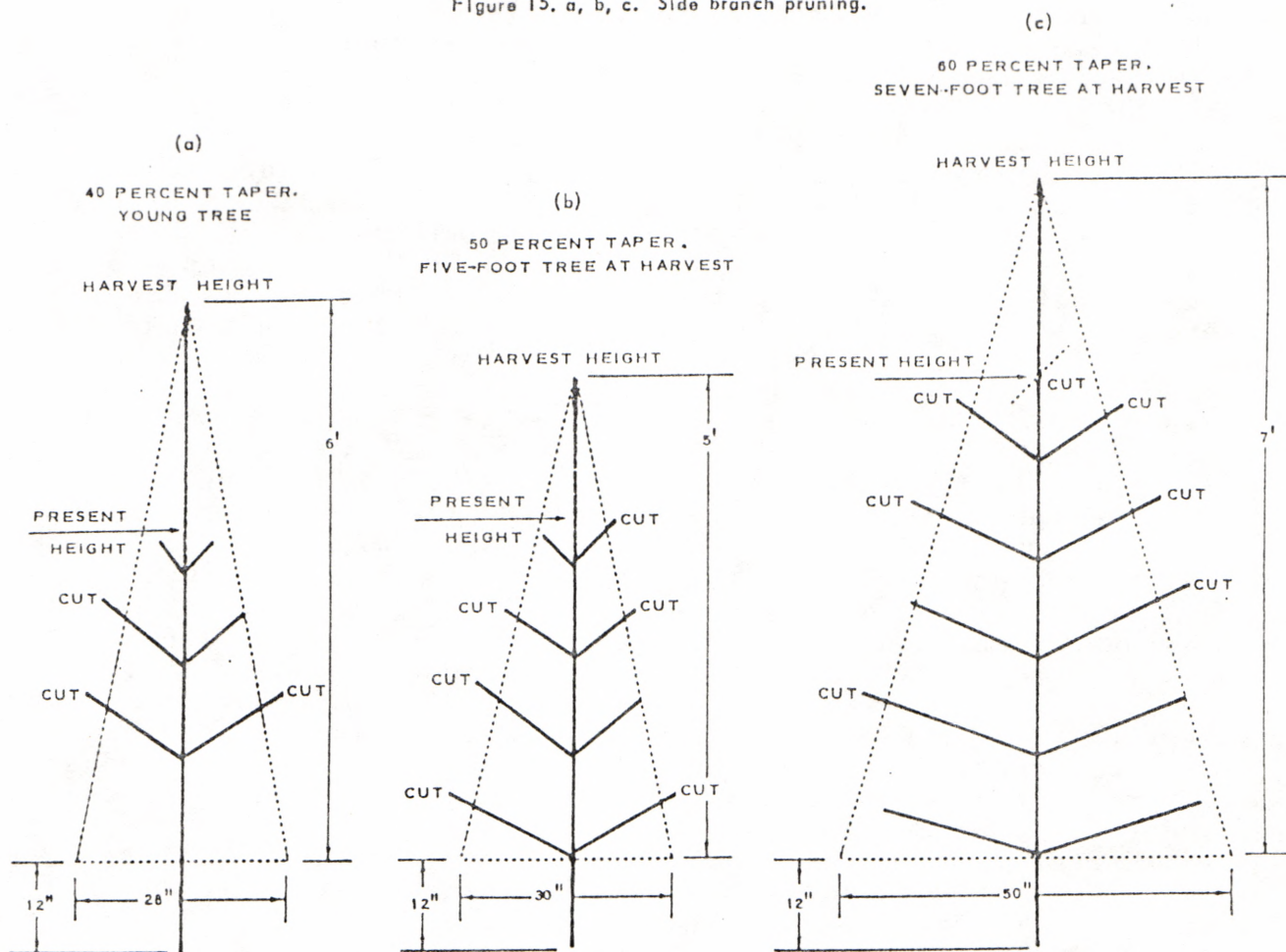
With proper leader and top whorl pruning, side branch pruning should not be required until the tree is at least three whorls high (3-1/2 to 5 feet).

A tree this size in January will be marketable by Christmas. Side branch pruning requires shaping trees to form a near perfect 50 to 60 percent taper. Tree taper percentage is determined by dividing the height the tree will be at the time of harvest into the width at the base of the tree. A 50 percent taper means the tree will be twice as high as it is wide. A 7-foot tree would have a 42-inch base with a 50 percent taper, and 50-inch base with a 60 percent taper. For an expected 7-

foot tree at harvest time, an imaginary line is drawn from the 42- or 50-inch foot base to the anticipated height. Any side branches that grow beyond that line should be cut.

Early pruning should be quite narrow, 40 percent to 50 percent taper, increased to 50 or 60 percent for the final pruning before harvest (see figures 15a, b and c).

Figure 15. a, b, c. Side branch pruning.



Do not use a shearing line from the present height of the tree to the base. It gives a heavy, oversheared, bushy appearance to the tree and causes a narrow top that seldom produces a premium tree. Remember, the shearing line should be to the height at which the tree is to be when harvested -- not to the present height of the tree.

Side branch pruning can be done with several types of tools. Accurate, straight shearing lines can best be obtained with a shearing machete or knife. Leg guards should be worn when using these tools. Mechanical hedge shearing equipment is used by some growers, others prefer long-handled hedge shears. A less intensive approach is to use hand clippers and do single branch pruning; this method, much more selective, takes longer and is done continuously throughout the year. Many growers using shearing tools will also use hand clippers for selective pruning. One annual shearing is usually enough with the shearing tools. Sometimes a second light shearing is needed about three months before Christmas.

Whatever tool is used for shaping side branches, growers should attempt to form a natural, unsheared, narrow-tapered tree. Near harvest, trimming should be only for cuts necessary to keep tree shape. The cuts should be hidden so stubs will be inconspicuous.

TIMING

Maximum growth in Monterey pine occurs from February through June; a short dormant period may then occur, lasting a few weeks, followed by slower growth until early winter. Growers should develop pruning schedules to reduce the number of times a tree needs to

be pruned. Amount and frequency of irrigations may influence pruning schedules, but basically the following theory is used.

Side branches. -- several pruning schedules have been formulated for shearing, but the results of a trial in Los Angeles led to the development of a very practical, time-saving schedule that most growers have adopted. If proper leader and top whorl pruning have been done as suggested, only one major shearing a year is needed when the new flush of growth is about three-fourth expanded; April 25 through June 15 is usually the best time. A light touch-up trimming may be needed from late August through September. If the heavy shearing is done earlier than April 25, this second pruning may be mandatory.

CAUTION: DO NOT PRUNE HEAVILY DURING HOT WEATHER, UNLESS THE TREES HAVE BEEN IRRIGATED THE PREVIOUS WEEK. IF PRUNED WHEN UNDER WATER STRESS, THERE MAY BE DIEBACK FROM THE CUTS.

Growers using the hand clipping method found that side-branch pruning is required throughout the year. Their heaviest pruning is usually done in January through March, secondary pruning being done as necessary. Concentrate on development of a 6- to 7-foot cone-shaped tree rather than a Christmas tree appearance at all stages of the tree's growth.

Leader. -- if required, the leader of an unmarketable tree should be cut in December or January to allow time for development of buds.

Once a basic shape on side branches has been developed, only leader pruning will be needed on a month-to-month basis during the spring growth and probably only once between July and October.

Excessive leader growth is easily spotted. When leader control is needed, a methodical row-by-row program should then be started. Only trees with excessive leader growth (top whorl branches will not adequately cover the stem) should be pruned.

HOW TO CARE FOR CUT MONTEREY PINE

Monterey pines are still actively growing when cut and do not last long without water. When the customer gets the tree home, they should cut half-an-inch off the butt end and place the tree in water.

Water should be added as needed to keep the cut end immersed. If the tree is to be stored before use, put the cut end in water in a cool place such as a shaded corner of the garage.

A 7-foot tree will use about one-half gallon of water per day for the first week. The stand, therefore, requires frequent filling. Keeping the tree in a semi-living condition results in an average house life of three weeks and maintains the tree's fire retardant characteristic.

SEEDLING SOURCES

California Department of Forestry
Davis Headquarters Nursery

P. O. Box 1590
Davis, CA 95616
Telephone: (916) 753-2441

^B
R & R Nursery
10772 North Purdue
Clovis, CA 93612
Telephone: (209) 298-3995

Other Information Sources
California Christmas Tree Growers
P. O. Box 1752
Lafayette, CA 94549
Telephone: (415) 283-8085

PEST CONTROL

Insect and Disease:

For a complete discussion of insect and disease problems in Christmas tree plantations, refer to the University of California Cooperative Extension publication "Insect, Mite and Disease Control Guide for Christmas Trees," Leaflet 2994.

Weeds:

The following list of herbicides are registered for use on Monterey Pines in California. No recommendations are implied, and other products may also be registered. Consult individual product labels for specific restrictions, rates and other instructions.

<u>Common Name</u>	<u>Trade Name</u>	<u>Basic Manufacturer</u>
Atrazine	Aatrex	Ciba-Geigy
Bensulide	Betasan	Stauffer
DCPA	Furloe	PPG
Diphenamid	Dacthal	SDS
EPTC	Enide	Tuco
Glyphosate	Eptam	Stauffer
Napropamide	Roundup	Monsanto
Naptalam	Devrinol	Stauffer
Oryzalin	Alanap	Uniroyal
Oxyfluoren	Surflan	Elanco
Paraquat	Goal	Rhom and Haas
Pronamide	Kerb	Chevron
Simazine	Princep	Ciba-Geigy

OTHER CONSIDERATIONS

Legal Requirements

- * A zoning permit is required in most counties.
- * A permit is required by the California State Board of Equalization since sales tax is imposed.
- * Sign permits may be required.
- * Liability insurance is prudent, if not actually required.
- * If live trees are to be sold, a nursery permit is required.
- * A retail sales license may be required.

IRRIGATION

Irrigation of Monterey Pine plantations is a necessity in most areas of California to insure rapid growth.

Methods of application commonly used include furrow, basin, border check, sprinkler and localized methods such as drip and mini sprinkler.

Due to close spacing, the maintenance of furrows and borders along with the need for access does not favor the furrow or basin methods. Furrow, basin and border check methods also require relatively large quantities of water for efficient irrigation. However if the land is relatively level and water is plentiful, irrigation costs with these methods can be low.

Sprinkler and localized methods of irrigation are most commonly used in California christmas tree plantations.

Advantages can be seen in:

Making best use of limited water supplies

Can be used on steep or variable terrain

Variable soils can best be accommodated

Easy automation

Fertilization through the system

Labor saving

Reduced tractor requirement

Disadvantages also exist:

Power is required

High initial cost of system

Sprinkling with low quality waters may harm foliage

In either sprinkler or localized methods, low operating pressure, even distribution through the plantation, as well as meeting anticipated water requirement should be system design goals.

IRRIGATION REQUIREMENT

The irrigation required on an acre basis depends upon climatic conditions and the land surface covered by the trees. Young trees cover less land and require less water.

The water requirement of christmas trees can be estimated by using monthly average reference Evapotranspiration (ET_o) values listed below. These values most closely approximate the use of a grass crop 4-5 inches high.

Average monthly ETo for Northern San Joaquin Valley in inches of water:

<u>Month</u>	<u>ETo</u>	
	<u>Monthly</u>	<u>Daily</u>
January	.85	.03
February	1.54	.06
March	2.93	.09
April	4.72	.16
May	6.22	.20
June	7.32	.24
July	8.06	.26
August	6.83	.22
September	5.32	.18
October	3.30	.11
November	1.42	.05
December	.61	.02

Two corrections to the ETo value are necessary to estimate christmas tree water use. One is the crop coefficient (Kc); the other is a correction for the size or the land surface shaded by the trees.

The crop coefficient currently used for Monterey Pine without cover crop is 1.2. The factor, in percent of mature tree water use for land surface coverage, is listed below.

<u>Percent of Ground Shade</u>	<u>Percent of Mature Tree Water Use</u>
10	25
20	45
30	65
40	80
50	95
60+	100

Example of determining irrigation requirement.

Given:

A) Monterey Pine plantation which shades 20 percent of land surface.

B) Time period: June 1-30.

C) Soil storage capacity of 1-1/2 inch available water per foot. (Clay loam)

D) Root zone of 2 feet.

E) Drip irrigation

ETo for June 1-30 = 7.32

Irrigation Requirement

$$\frac{\text{ETo} \times \text{Kc} \times \text{coverage factor}}{\text{*Application Efficiency}} = \frac{7.3" \times 1.2 \times .45}{.90} = 4.4 \text{ in.}$$

*Application efficiency varies with system and management.

Listed below are typical values.

<u>System</u>	<u>Application Efficiency %</u>
Basin	50-80
Border Strip	40-80
Furrow	40-70
Sprinkler	60-85
Drip	80-95

WHEN TO IRRIGATE

Monterey Pine generally has the bulk of its roots in the upper 2 feet of soil. The goal is to maintain a moisture condition in this area which will favor rapid growth.

Since depletion of all the available moisture from the soil would result in plant stress and poor growth, it is necessary to irrigate when approximately 50 percent of the available water is depleted.

Soils retain different amounts of water mainly as a function of texture. Available water holding capacity of different texture soils:

Inches/foot Soil Water

Sandy 1/2 - 3/4
Loamy 3/4 - 1-1/2
Clayey 1 - 2

Using our example above where 4.4 inches is required for the month of June; if on June 1st the root zone is full with water then it would take 10 days ($\frac{4.4 \text{ inch}}{1.5 \text{ in.}}$) to deplete the 1.5 inches of water determined to be for use in the root zone.

An irrigation should be planned near June 10 to replenish that used by the trees. Application of more water will result in water

percolating past the root zone and will be out of reach of the trees.

These water requirements are based on field studies where the soil moisture was maintained at an optimal condition for the entire year. However, it should be noted that maximum water use may not produce optimum ornamental quality of christmas trees.

EVALUATING SOIL MOISTURE

The use of a soil auger or shovel to check the soil moisture level of the root zone is necessary to check other scheduling methods. Tensiometers are also a very effective method of monitoring soil moisture status.

Other bulletins are available covering:

Basic Irrigation Scheduling
Leaflet 21199

Questions and Answers about
Tensiometers Leaflet 2264

Drip Irrigation Management
Leaflet 21259

Irrigating Deciduous Orchards
Leaflet 21212

FERTILIZATION

The fertilizer requirements for christmas trees are not well defined. Current knowledge of fertilizer practices indicate the

response of christmas trees to fertilizer is a function of both site and tree growth conditions.

Conditions of major importance include:

Soil nutrient status

Stage of growth

Climate

Rate of growth expected

Irrigation practices

Soils deficient in required nutrients produce slow growing, spindly trees that have short yellowish needles. Depending upon site conditions, applications of sulfur, potassium, as well as nitrogen may be beneficial. The necessity or rate of fertilizer is best evaluated by onsite testing.

In natural stands of white fir, fertilizer trials showed best results (although not necessarily best economy) when 160 pounds of nitrogen were applied per acre.

The timing of nitrogen application is also important. A single application should be made before the end of the rainy season. When irrigation is used, a split application where two thirds of the seasonal requirement is applied in the spring and one third in the late summer may be more appropriate. A split application can increase nitrogen utilization efficiency thus reducing the seasonal requirement.

When nitrogen fertilizers are injected through a drip system using multiple applications, the rate of fertilization can be reduced substantially.

When trees are small, fertilizer should be applied near the tree in the area of active root growth. Young trees require less fertilizer on a per tree basis than mature trees and should be fertilized based on land surface shaded. For example, to fertilize, using Ammonium Sulfate (21-0-0), on a young 30 percent ground shaded plantation with a 5 by 5 foot spacing (1,742 trees per acre):

$$\frac{\text{Pounds of Nitrogen per acre} \times \text{land surface shaded}}{\text{Elemental Analysis of fertilizer} \times \text{trees per acre}} = \frac{160 \times .30}{.21 \times 1,742} =$$

$$0.13 \text{ lbs/tree (2.13 oz./tree)}$$

As trees grow to explore more soil area, fertilizer can be broadcast applied.

PRODUCTION COSTS

Cost of growing trees in a plantation include cultural, harvest, and overhead costs. These costs will vary by species grown, location, equipment availability, and other circumstances. Cultural costs include clearing, planting, weed control, shearing, and fertilization, to name a few.

Harvest costs include labor, equipment for cutting, bundling, and loading trees. Needed security is also a harvest cost. Overhead costs include taxes, depreciation of equipment, such as fences, irrigation equipment, buildings, etc., interest on investment, and accumulated costs. Management, such as secretarial help and advertising, is also an overhead cost. Total costs per acre of up to \$4,000 can be incurred before any income is derived. Of this amount, cultural

costs vary from 30 to 40 percent; harvesting costs vary from 10 to 40 percent; and overhead costs vary from 40 to 60 percent.

Taxes are an important consideration when assessing costs. Taxes affecting the Christmas tree operation include yield, property, and income taxes. If forest land is zoned by the county as "Timber Production Zone" (TPZ), your property tax may be reduced. In addition, a yield tax is applied to the sale of your trees, which is a flat percentage of the value of the tree. Your county planning department or tax assessor has the information required to apply for timber production status.

Income tax is paid at a normal rate if the harvested trees are no older than six years from seed. If the tree is older than six years from seed, the capital gains rate can apply to your income. Some management expenses can be capitalized and others are expensed. Consult an accountant experienced in timber or Christmas tree taxation for specific details.

MONTEREY PINE CHRISTMAS TREE PLANTATION

Cost Analysis Work Sheet - 1985

This worksheet was developed to show sample costs for establishing

a Monterey Pine plantation in San Joaquin Valley. These costs are useful as a guide. Be aware, however, that your costs will vary depending upon cultural techniques. This cost study was based on the following factors.

1. Costs are based on a planting of 10 acres, 1740 trees per acre on a 5'x5' spacing, furrow irrigated.
2. Tree loss with furrow irrigation was calculated at 25 percent of the original stand. Under sprinkler or drip irrigation system, the mortality rate can be lowered considerably.
3. The accumulated net profit as shown at the end of the fifth year must be interpreted with caution. The reason being that at this time the potential Christmas tree market has passed the saturation point.
4. With an increase in the number of Christmas trees reaching merchantable size in the next two or three years, the cost of marketing and advertising will increase significantly. If a surplus of Christmas trees materializes and many trees remain unsold, the net return will be reduced to a nonprofitable basis.

MONTEREY PINE CHRISTMAS TREE PLANTATION

			COST PER ACRE				
			YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
LABOR \$/HR			5.50				
EQUIP. LABOR \$/HR			6.50				
CULTURAL COSTS							
		HRS/AC					
LAND PREP.							
DISC & HARROW 2X							
LABOR & TRACTOR	1		14.46				
RIDGES 5' CENTER							
LABOR & TRACTOR	.5		7.23				
TREES/AC	1740						
COST/1000	95.00		165.30				
PLANTING		90	495.00				
REPLANT				148.50	33.00		
REPLACE HARVEST TREES						88.00	264.00
IRRIGATE 7X			30.25	41.25	55.00	66.00	66.00
FERTILIZE (2nd YEAR ON)							
LBS N	75.00	.22/LB		16.50	16.50	16.50	16.50
LABOR COST/AC		3		16.50	16.50	16.50	16.50
WEED CONTROL			40.00	40.00	40.00	40.00	40.00
INSECT & MITE CONTROL				23.90	27.00	31.50	31.50
SHAPING & PRUNING				460.00	740.00	824.00	264.00
ADVERTISE & PROMOTION					100.00	100.00	100.00
TAXES			30.00	30.00	42.00	42.00	42.00
REPAIRS			12.00	6.00	15.00	15.00	15.00
REMOVAL UNSALABLE TREES							30.00
OFFICE, INSURANCE, ETC.			70.72	71.25	95.50	107.80	79.48
TOTAL CULTURAL COSTS			864.96	853.9	1180.5	1347.3	964.98
=====							
DEPRECIATION							
IRRIGATION SYSTEM & WELL							
\$/ACRE	YEARS						
400.00	20		20.00	20.00	20.00	20.00	20.00
EQUIPMENT							
550.00	20		13.75	13.75	13.75	13.75	13.75
TOTAL DEPRECIATION			33.75	33.75	33.75	33.75	33.75
=====							
INTEREST ON INVEST. .12							
1/2 COST							
IRRIGATION SYSTEM	200.00		24.00	24.00	24.00	24.00	24.00
EQUIPMENT	275.00		33.00	33.00	33.00	33.00	33.00
LAND	3000.00		360.00	360.00	360.00	360.00	360.00
INTEREST ON ACCUMULATED COST			.00	157.89	333.75	221.91	.00
TOTAL INTEREST			417.00	574.89	750.75	638.91	417.00
=====							
TOTAL COST FOR YEAR			1315.71	1462.54	1965.00	2019.96	1415.73
=====							
YIELD: HARVESTED TREES							
			0	0	290	875	325
INCOME A \$/TREE	10.00		.00	.00	2900.00	8750.00	3250.00
INCOME B	20.00		.00	.00	5800.00	17500.00	6500.00
=====							
ACCUMULATED NET PROFIT A			-1315.71	-2778.25	-1843.24	4886.80	6721.07
ACCUMULATED NET PROFIT B			-1315.71	-2778.25	1056.76	16536.80	21621.07

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