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SHAPING CHRISTMAS TREES

Thomas J. Nichols
Extension Specialist, Forest Biology*

Introduction

The shaping of Christmas trees, cutting branches to improve the tree's appearance, is the single most important factor affecting tree quality and varies greatly between growers. Without proper shaping, tree quality is rarely high enough to produce adequate profits to growers. High quality is especially important as more trees approach harvest age and markets tighten.

Shaping improves the outline and branch density of a tree. It includes shearing (cutting back the current year's growth) and pruning (a corrective process to remove growth older than one year). Since most growers identify "shearing" as the entire "shaping" operation, this text uses the term "shearing" to include both shearing and pruning.

The shearing operation is time-consuming, typically requiring 15-20 man-hours per acre annually and ranging from 5 to 35 hours per acre depending upon tree size and tools used. Skilled labor is difficult to find for the short shearing period, and many growers become overwhelmed with the time requirements for this operation. In the third or fourth year after planting, when shearing requirements begin increasing, many growers abandon the cultural operations and never produce marketable Christmas trees.

Shearing is both an art and a science. Shearers frequently learn only the basic techniques and develop the art as they gain experience. Often, the only techniques learned are how to shear the "perfect tree." They frequently don't know what to do with problem trees. To help growers understand and adapt to shearing problems, this text introduces the biological principles that affect shearing. Techniques for basic shearing are described, and methods for corrective pruning discussed.

Purposes for Shearing

Although shearing techniques differ somewhat between species, the basic principles are the same. The goal of shearing is to produce a tree with one central stem, a conical crown, and a balanced density of foliage at harvest time.

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*Department of Forestry, College of Agriculture and Life Sciences, Virginia Tech, Blacksburg, VA 24061.

Some species regularly form a central main stem. Frequently, however, birds, insects, or other factors (including shearing mistakes) cause damage to the main stem, and much effort is required to regain a dominant central stem.

Few unsheared trees have conical shapes of the desired taper. Shearing strives to shape the crown into a balanced, inverted cone. Proper taper, the ratio of crown width to height, is adjusted according to species (Figure 1). (A 6-foot tall tree with 67 percent taper is 4 feet wide.) Growers should try to achieve tapers of 60 to 75 percent for pines; acceptable standards are 40 to 90 percent. Taper for firs and spruces should be 50 to 60 percent; acceptable standards are 40 to 70 percent. Since consumers differ in their preferences for taper, not all trees should be sheared to the same taper. Each tree should be judged to determine the preferred taper within the accepted standards. A common mistake is to produce trees with too much taper by being afraid to shear enough off lower branches.

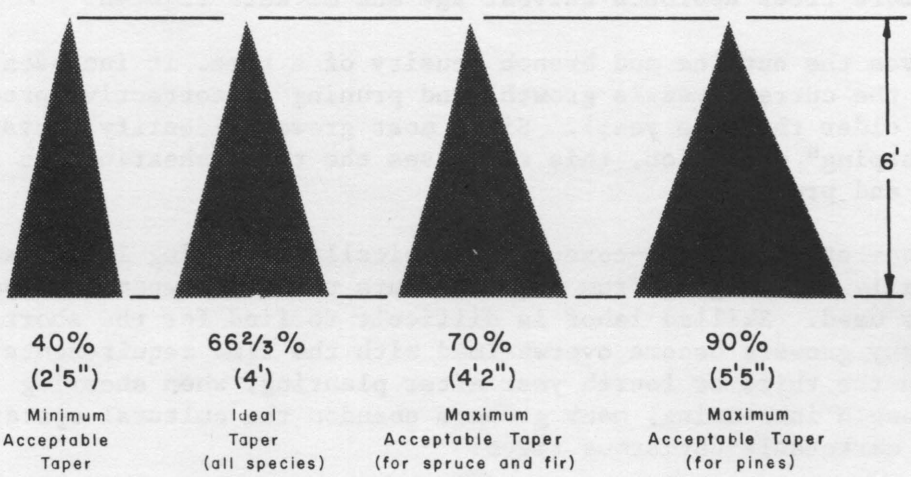

Figure 1. Guide to taper for Christmas trees.

Unsheared trees rarely have adequate branch density. Shearing increases branch density and helps balance the crown, eliminating branchless spaces in the crown. The desired density differs between species. Pines are normally sheared so that crowns display a solid covering of foliage. Firs and spruces are sheared less densely, with their inner branches more visible.

Biological Basics

Figure 2 identifies tree parts discussed in the text.

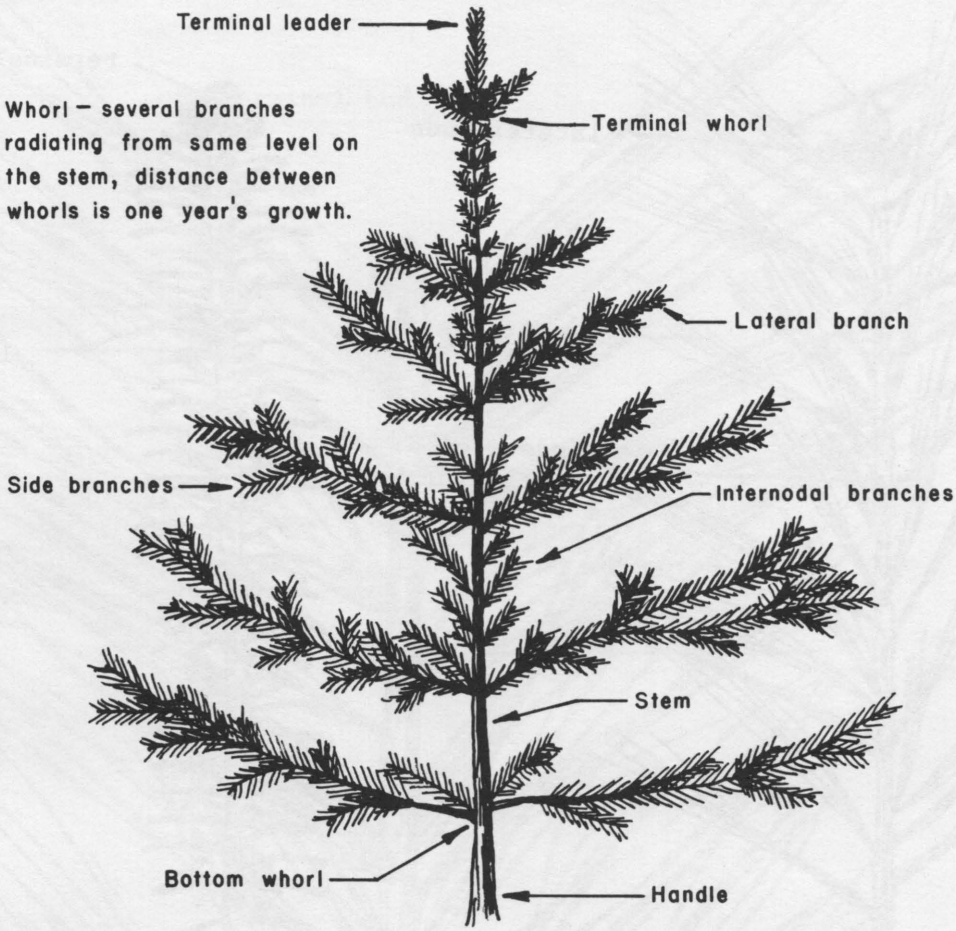

Figure 2. Christmas tree terminology.

Effects of Shearing

The processes of budset and shoot growth differ between tree species, thus dictating different shearing techniques. Buds are formed at the ends of the terminal leaders on unsheared pine trees (Figure 3). These buds produce branches at what becomes the terminal whorl the following year. Undeveloped fascicular buds (invisible to the naked eye) are located at each position where a bundle of needles is attached to the stem (i.e., each needle fascicle). Growth-inhibiting hormones sent out by the terminal buds keep these buds from developing. Without shearing, shoots (new branches) on pines grow mostly from the few buds at the terminal of the stem and at the tips of each branch. Unsheared pine trees develop several branches at each whorl, and the areas of stem between whorls have few branches; such trees have thin branch density. In contrast, buds on fir and spruce trees are dispersed along the terminal shoot, with some, but not complete, concentration toward the top (Figure 3).

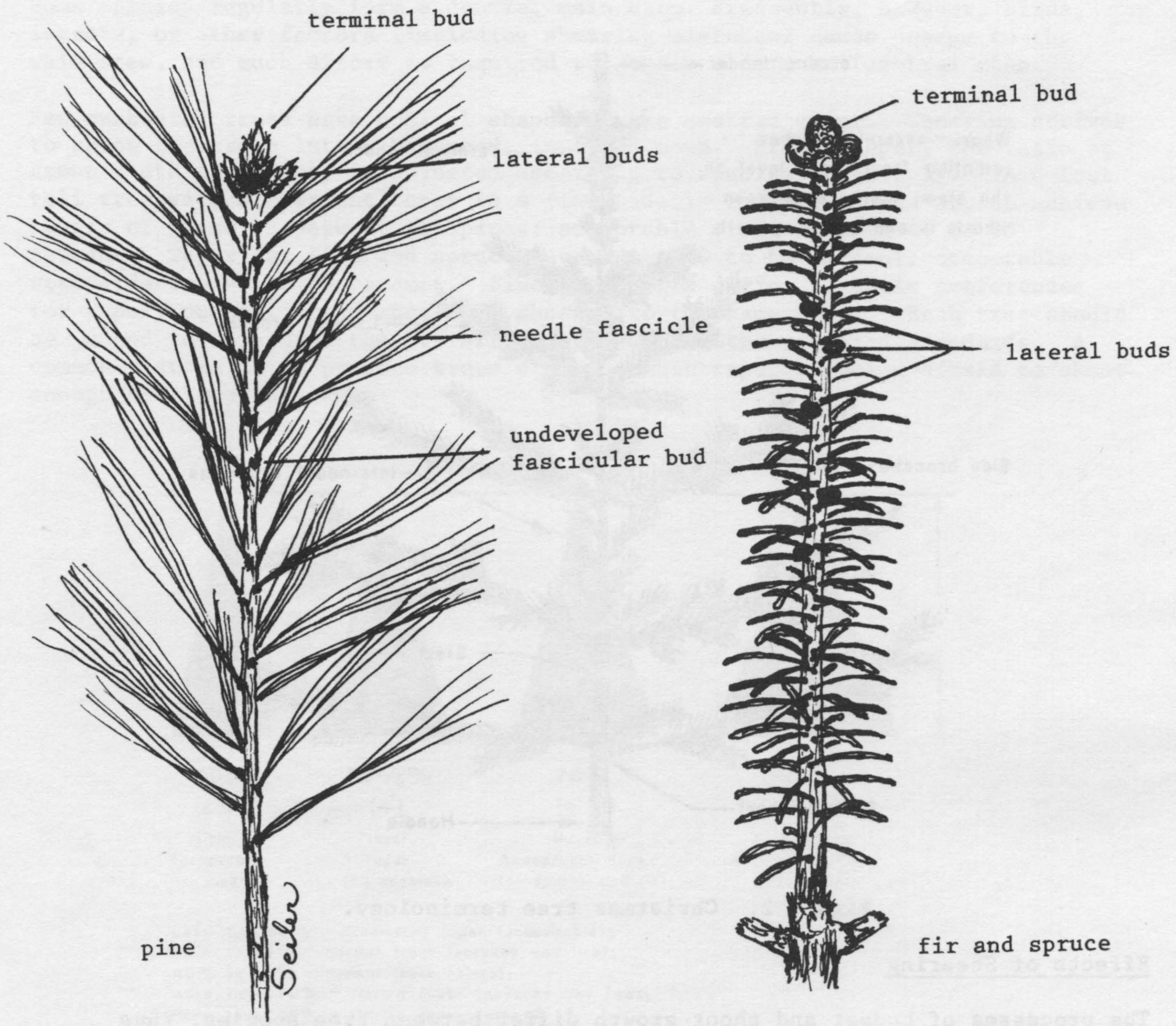

Figure 3. Bud formation on unsheared pine (left) and fir shoots (right), (illustration by John Seiler).

Shearing improves branch density and distribution. By annually removing parts of the terminal and lateral shoots, new branches are formed closer to those of the preceding year. On pine trees, removing the terminal and original lateral buds by shearing also eliminates the production of growth-inhibiting hormones, allowing more undeveloped fascicular buds to develop (Figure 4). The number of fascicular buds that develop is greater than the number of original buds removed, and branch density increases. Unlike unsheared trees, the buds and subsequent shoots are dispersed more along the terminal shoot, and long expanses of stem without branches are less common. Shearing causes new (adventitious) buds to form on spruces and firs, but the increase is not as great as on pines.

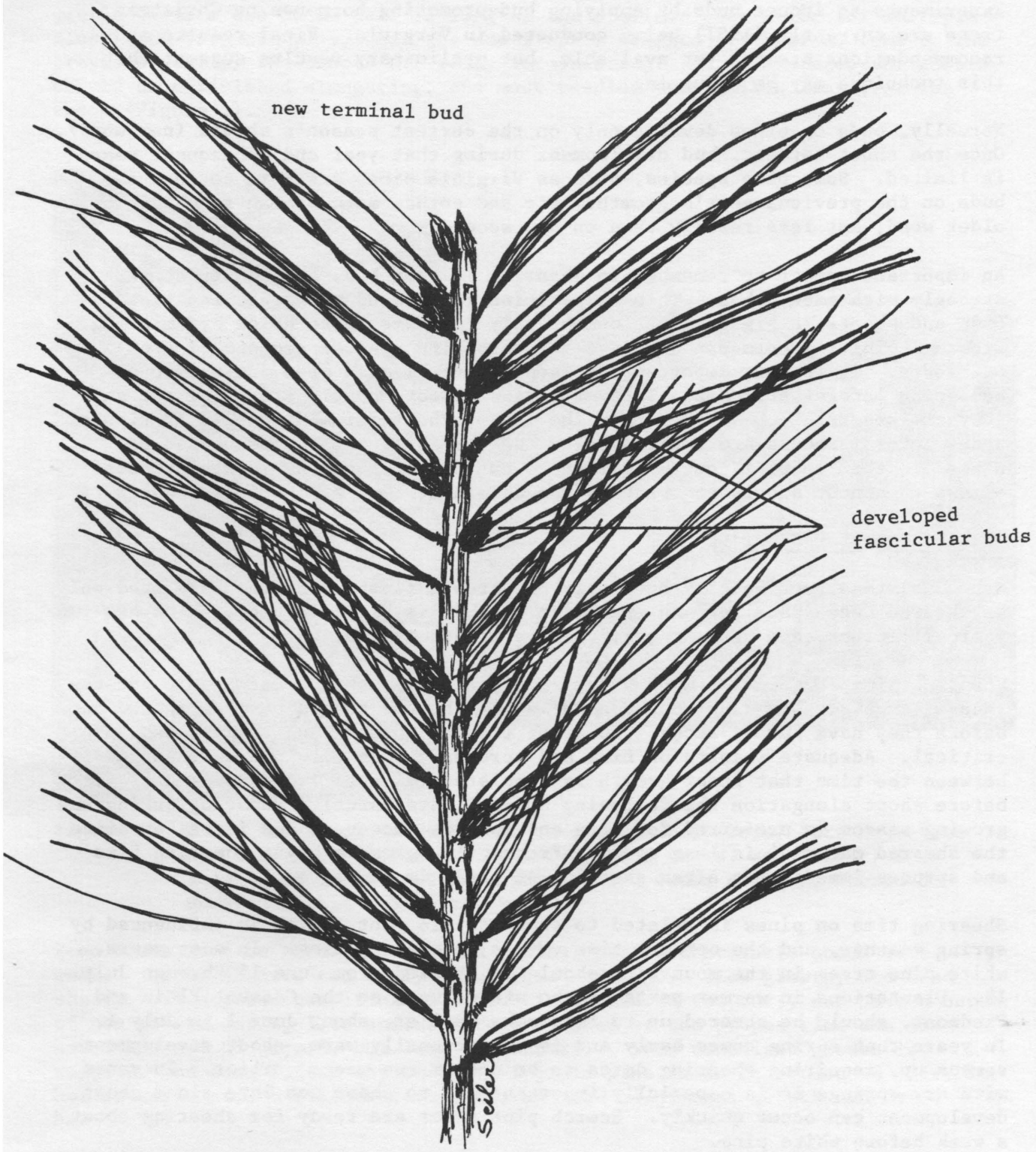

Figure 4. Bud formation on a sheared pine shoot (illustration by John Seiler).

Experiments to induce buds by applying bud-promoting hormones on Christmas trees are currently (1987) being conducted in Virginia. Final results and recommendations are not yet available, but preliminary results suggest that this technique may be promising.

Normally, buds on pines develop only on the current season's shoots (new wood). Once the shoot hardens, bud development during that year and subsequent years is limited. Some pine species, such as Virginia pine, are able to form new buds on the previous year's growth. Fir and spruce species can form buds on older wood, but less readily than on new wood.

An important aspect to remember in shearing is that buds and shoots compete strongly with each other. This competition is related to height location. Buds and shoots in higher locations usually dominate those below by emitting growth-inhibiting hormones downward and absorbing greater amounts of tree nutrients. It is most important to keep a central main stem dominant over competing lateral branches. Tips of lateral shoots should always be cut so they are several inches lower than the tip of the terminal leader. If tips of uncut lateral shoots are located below the terminal, their ends should be nipped if the leader is cut. Failure to cut the ends of the lateral shoots allows the uncut shoots to overtake the terminal, causing multiple leaders.

Time of Year for Shearing

Most Christmas tree species have only one growth flush each year, and need only be sheared once annually. An exception to this is Virginia pine, which has two to four flushes each year, requiring more frequent shearing.

Shearing time for pine species is critical, since new buds must develop on the sheared shoots. Shearing should occur after the new shoots have elongated but before they have turned woody. Shearing time on spruces and firs is less critical. Adequate results on firs and spruces can be obtained by shearing between the time that shoot growth is completed (mid- to late June) until just before shoot elongation the following spring (late March). Shearing during the growing season is preferred for firs and spruces, however, and is easier since the sheared material is less woody. Frequently, growers begin shearing firs and spruces immediately after shearing of pines is completed.

Shearing time on pines is related to shoot development, which is influenced by spring weather, and the optimal time varies between species. In most years, white pine trees in the mountains should be sheared from June 15 through July 15. Plantations in warmer parts of the state, such as the Coastal Plain and Piedmont, should be sheared up to two weeks earlier, about June 1 to July 1. In years that spring comes early and is exceptionally warm, shoot development speeds up, requiring shearing dates to be one or two weeks earlier. In years with dry springs it is especially important not to shear too late since shoot development can occur quickly. Scotch pine trees are ready for shearing about a week before white pine.

Virginia pine trees may need shearing in mid- to late May, again in mid-June, and sometimes again in late summer. Observations of shoot development are critical for determining shearing time. A simple indicator for determining when to start shearing all pine species is needle length. When the current

year's needles are about half as long as the previous year's (or for multiple flushes on Virginia pine, when the new flush's needles are half as long as the previous year's) the shoots are ready for shearing. At this stage, the shoots should have finished elongating, and most needles have fallen away from the shoot (Figure 5).

Figure 5. Shoot and needle development on pine trees; (left) late May--tree won't be ready for shearing for several weeks, and (right) late June--tree could have been sheared 1-2 weeks earlier, should be sheared within 2-3 weeks.

Pine trees must be sheared during an optimal period that lasts about five weeks. Trees sheared too early form fewer buds, have slow growth, and dead shoots. If weather conditions permit, trees sheared too early can have a burst of new growth during late summer (trees sheared at the proper time can also have this second growth, but less frequently). This undesired growth is spindly, and poor budset may occur. Virginia pine is an exception to this; it has multiple growth flushes each year, and the additional growth can be beneficial.

Pine trees sheared too late may not have adequate time to develop new buds, and shoots may harden too much for optimal bud development. Many small buds can develop, and growth the following year will be poor, giving a "birds'-nest" effect. If winter arrives late in a year that trees are sheared late, good budset may occur, but this can't be predicted.

Equipment and Safety

Shearing Equipment

A variety of tools are used for shearing Christmas trees (Figure 6). Use of specific tools is determined by cost, size of operation, tree size, speed, comfort, experience of the shearing crew, and perceived safety factors. Used properly, all of the tools can produce quality work, but some have advantages over others. Growers should carefully consider the values of purchasing high quality tools. For instance, a lightweight shearing knife may cost more, but is appreciated during a long day's work.

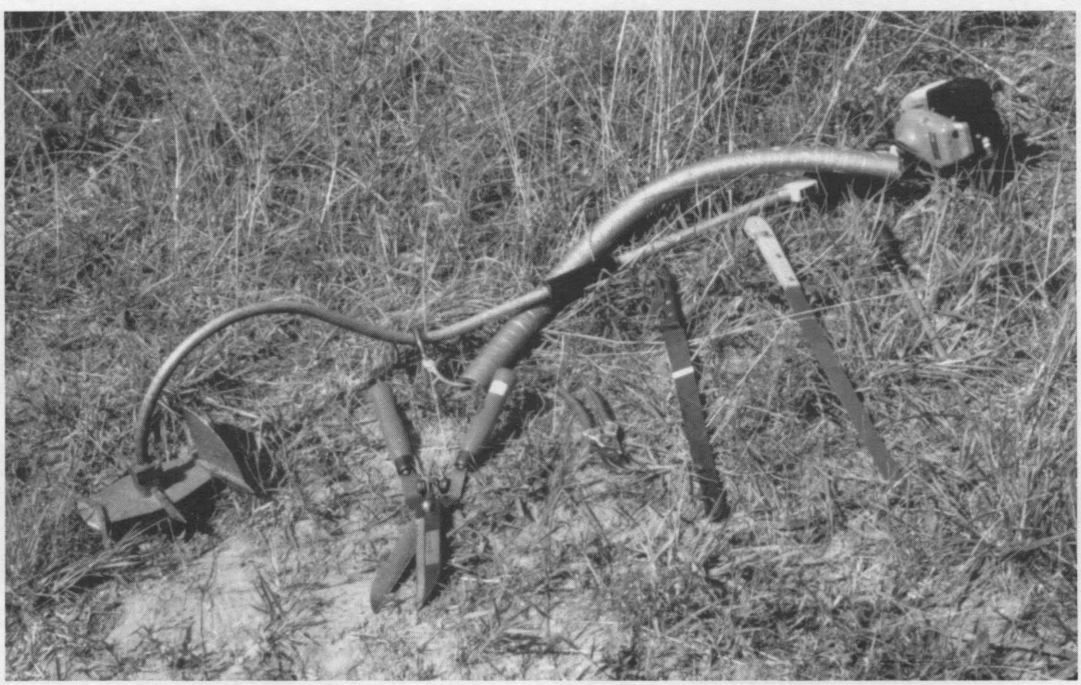

Figure 6. Shearing tools -- (top) hand-held motorized shearer; (bottom, left to right) hedge clipper, hand pruner, two shearing knives, and a sharpening steel.

Small hand pruners are rarely used to shear entire trees. The hand pruner is a valuable tool for correcting particular branch and shoot problems. It may also be used for carefully pruning shoots at the tops of trees and for clearing around the bottom of the stem. It can be used for pruning out unwanted hardwood stems and vines, since using other tools for this can damage their blades. All shearers should carry a hand pruner, and many growers carry one when they are in the field at all times of the year.

Hedge clippers were frequently used for shearing in the past, but their use has decreased. Shearing with clippers is slow, fatigue can be great, and it is difficult for inexperienced shearers to produce trees with smooth sides. Some experienced shearers who use hedge clippers, however, produce top quality trees as rapidly as with other hand shearing tools. There is less chance for serious accidents with clippers than with some other tools. Hedge clippers are especially useful for shearing small trees (less than 4 feet tall). Good

quality clippers with strong blades and a rubber bumper between the handles should be used.

Shearing knives are the most common tools used for shearing. They are inexpensive, production rates are good, and new shearers can produce good quality trees fairly quickly. The long, sharp blade can be dangerous if safety precautions are not taken, but accidents are rare when shearing crew supervision is good.

The use of mechanized shearing tools in Virginia has increased in recent years. Hand-held tools powered by battery or gasoline have proved economical for shearing trees at least 4 feet tall. Production rates with these tools are often two to three times greater than with knives, but workers usually tire quicker. Tree quality is sometimes better with mechanical tools since a straight line of branches can be cut easily on the sides of the crown. Two models on the market use a circular head, making it is easy to swing the bar holding the head in a straight line alongside the tree. Another model uses a long bar with reciprocating teeth, automatically cutting a straight line. Large self-propelled shearing machines are also available, but their use in Virginia is rare because of high machine cost and terrain limitations.

Shearing with dull tools can harm the trees by tearing rather than cutting the shoots, resulting in poor budset. Dull knives also produce greater arm fatigue that may result in accidents. Knives should be sharpened daily as a minimum; many shearers change or sharpen knives at lunch time and touch up the edges frequently in the field. Some growers allow only crew chiefs to sharpen knives in order to reduce accidents and ensure proper edges on the blades. Sap on blades should be removed daily as a minimum. Safety precautions, including wearing gloves, must be followed when sharpening or cleaning tools; accidents sometimes occur more often during these operations than during shearing itself.

Safety Considerations

Common sense is the most important safety factor affecting shearing. Most accidents occur when safety precautions are not followed. Maintaining safety-conscious shearing crews and good supervision minimizes accidents, regardless of tools used. Protective clothing can help prevent accidents but is not a substitute for following good safety precautions. Leg chaps (Figure 7) can prevent injuries to legs. Frequently, a chap is worn on only the shearing-side leg (right-handed shearers should wear a chap on the right leg). The glove shown in Figure 7, worn on the non-shearing hand, is specially made for shearing, with metal staples that prevent the knife from cutting into the glove. Safety goggles should be worn when motorized shearing tools are used.

When using a knife, it is easy to forget safety and put the non-shearing hand in front of the knife. Holding something in this hand prompts the shearer to hold this hand at his side, reducing risks. Many shearers hold a hand pruner for doing quick branch corrections, and some hold a sharpening steel to touch up the knife edge. A stick held in this hand can be used to hold back non-target branches while shearing other branches.

Figure 7. Protective chaps and glove (left hand) worn when shearing with knives.

Shearing knives should always be swung away from the body (Figure 8). Swinging a knife back toward the body, a tempting practice when shearing branches missed in earlier strokes, greatly increases the chance for injury. Backing around the tree - away from the blade - as one advances (clockwise for a right-handed person), reduces the risk of cutting into the leg as the shearer advances around the tree, and reduces the temptation to correct missed branches by swinging the blade toward the body. (It is more difficult to view the next area to be cut, however, when backing.) Standing up against each tree further reduces the risk of cutting one's leg with a knife, but sharp needles and stiff twigs on some species may make this difficult. Also, if the shearer backs around the tree, less sap is contacted since fewer sheared shoots are brushed.

When more than one person is shearing they should keep at least one row of trees between them. When individuals concentrate on the trees they are shearing they are less apt to notice those who come into their danger zone. Fatigue among shearers should be monitored; fatigued shearers forget safety precautions and make mistakes.

Figure 8. Shearing knives should be swung away from the body to avoid injury.

Basic Shearing Techniques

Shearing techniques differ, depending upon the size of the tree. Techniques for shearing are discussed in three stages: (1) early pruning to develop one central stem and a balanced crown, (2) mid-stage shearing to improve branch density and develop a conical-shaped framework, and (3) light shearing to maintain shape just before harvest.

Early Pruning and Shearing

During the first one to three years after planting, complete tree shearing is not necessary. Branch growth is limited so there is little need to shorten the branches to improve density. Some minor shaping is done on selected trees. Multiple leaders are removed to create a central stem, and damaged, crooked, crossed, or weak branches are removed. Some growers begin pruning "handles" (removing lower branches; see Special Pruning Situations) on trees when they are small; most handle-pruning is done during the third year. Branch removal can be done during any time of the year, making it a good idea to carry hand pruners whenever walking the field.

Long lateral shoots that are competing with the terminal shoot should be cut back to 2/3 the length of the terminal shoot, and shoots that greatly affect

the balance of the tree should be cut back. If several laterals are cut, it is good practice to nip the ends of the terminal and remaining laterals of the top whorl, even if they are not too long, since growth could be directed to them and result in over-length shoots.

When cutting the terminals of pine trees, cuts can be made anywhere on the new shoot where there are 4 inches of needles below. Buds will develop at the needle fascicles. Cut the terminal shoot at a 45-degree angle to help develop a dominant bud and maintain a single main stem. On firs and spruces, the next year's growth will come from buds already visible, and the cut should be 1/4 inch above a single healthy bud. Cutting any higher will leave a dead stub; cutting above a group of several buds can promote multiple leaders.

Small trees should not be shaped to look like miniature Christmas trees. The base of the tree should be allowed to grow in width, and shearing of long branches should be minor, especially on spruces and firs. After a good base (wide and dense) is developed, the width can be controlled.

Mid-Stage Shearing

When terminal shoots exceed 12 inches, the trees are usually 2 to 3-1/2 feet tall and are ready for shearing. With white and Scotch pines this usually occurs during the third year after planting; in Virginia pine, it can occur in the second year, and with spruces and firs, it can be the third to fifth year. Small trees have several years to recover from mistakes, prompting many growers to train new shearers on small trees. It is important, however, that shearing of small trees be done properly, since early shearing develops the framework for shearing in future years. Trees properly sheared when 3 to 4 feet tall can be easily sheared in future years.

There are numerous ways to shear trees, and techniques can vary depending upon the tools used. But, the principles and objectives of shearing remain the same regardless of techniques and tools. The technique discussed in this text is designed for teaching new shearers the principles of shearing. It allows a reasonable production rate but can be adapted to speed production as the shearer gains experience. Most of this description is limited to knife-shearing, but the principles can be used for shearing with any tool.

Shearing is done in two stages: (1) shaping the top of the tree and (2) shaping the remaining body of the tree. Their order varies between shearers. The author prefers shaping the top first and using the shaped top to determine the shape of the body. The first step is to select the terminal shoot, the shoot which will form the main stem. This shoot is apparent on most trees but sometimes multiple leaders develop. The shoot should be healthy and reasonably straight (some straightening can occur after shearing). It should dominate surrounding shoots and be in the center of the crown. Sometimes special shearing and corrective pruning must be done to develop the terminal shoot, as discussed in the next section. Other corrective pruning, such as removing damaged, crooked, or crossed branches, should also be done at this time.

Cut the terminal to about 12 inches in length (Figure 9). On pines, cut at a 45-degree angle anywhere on the current year's shoot where there are at least 4

inches of needles below; on spruces and firs, cut 1/4 inch above a single healthy bud. Many shearers carry a stick or piece of PVC pipe marked at twelve inches, or mark their shearing knife to determine this proper length. Leaving too long a terminal will result in excess space between branches. Too short a terminal will produce an overly dense tree and increase the time needed to produce a tree tall enough for market. Some growers shear terminals shorter, to 8 or 10 inches, when trees are small and leave longer terminals, 14 to 16 inches, when the trees are taller. This technique is difficult for new shearers to learn.

Figure 9. The terminal shoot should be cut back to 12 inches; inexperienced shearers should use a reference mark on a stick, PVC pipe, or their shearing knives.

Lateral shoots in the top whorl should be cut to 2/3 the length of the terminal, or about 8 inches for a 12-inch terminal. If using hand pruners, don't bother cutting each branch individually; instead, all shoots on 1/3 to 1/2 of the top whorl can be bunched and sheared with one cut. If carrying a stick or pipe marked at 12 inches, another mark at 8 inches can be used to determine lateral shoot length (Figure 10).

The remaining branches down the stem are sheared to the desired taper using the shaped top as a guide. An imaginary line should be drawn from the top of the tree through the lower branches, shaping the tree as a cone (Figure 11). Both feet should be firmly planted before the shearing stroke is started. Each stroke should shear a path of shoots about 6 inches wide. Using only full strokes, shear from the top of the tree to the lower branches with the imaginary line as a guide. It is difficult to maintain a straight line following the taper if partial strokes are used. Using a short stroke at the top of the tree followed by a long stroke for the remainder can result in a rounding of the tree near the top, producing "shoulders." Using a long stroke from the top, then shearing the lower branches with a short stroke will round the bottom of the tree, producing "hips."

Figure 10. Cut lateral shoots in the top whorl to 2/3 the length of the terminal shoot.

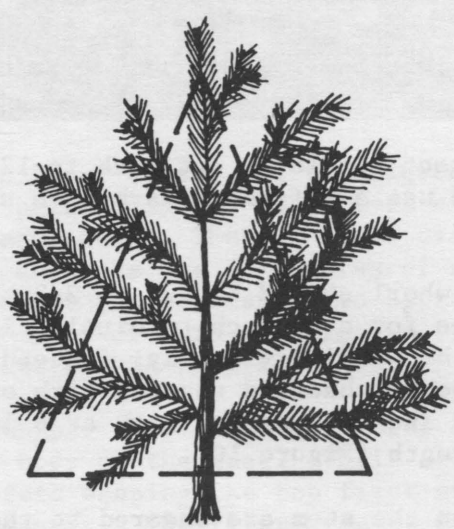

Figure 11. Shearers should picture in their minds the desired taper for the tree, then shear along the imaginary lines.

Some growers use one crew to shape the tops of trees with hand pruners or hedge shears, and a second crew to shear the body with knives or motorized tools. The crew shearing the tops performs any detailed corrective measures needed. If a marked stick is used for measuring top shoots, inexperienced shearers can quickly learn to shear the tops. Accidents to inexperienced shearers can also be reduced if they use hand pruners or hedge clippers to shear the tops.

As shearers become experienced, techniques can be adapted to speed production rates. It is fairly simple to shear lateral shoots in the top whorl to 2/3 the length of the terminal, so after a little experience the need to measure laterals is reduced. Similarly, the shearer may quickly adapt to cutting the terminal to 12 inches, and this measurement can be dropped. Even experienced shearers, though, will check their reference periodically to be sure that they are shearing to correct lengths.

After practice in shaping trees in two stages, experienced shearers can shear the top and body in one step. The shearer pictures the imaginary cone and shears from the very top to the bottom in one stroke, making only one circuit around each tree. It is best to shear the terminal shoot separately from the rest, however, to ensure proper selection and shearing of this important shoot. Small trees (during the first year of shearing) are often sheared in one step. After shearing the terminal shoot, the shearer stands over the tree, with hedge clippers held upside-down at a 30-40 degree angle from the stem, and trims the lateral shoots in the top whorl as he moves around the stem. Over-length branches below the top whorl should be cut if they greatly affect tree balance; otherwise, shearing that restrains outward growth of the lower branches should be avoided.

Harvest-Time Shearing

Shearing in the final year or two before harvest should be minimal. If the trees were sheared properly in the mid-years, a balanced framework of branches should be present and only light shearing will be required. Heavy shearing just prior to harvest gives trees an unnatural look; many cut stubs and needles are visible. Heavy corrective pruning is visible since the new growth needed to cover holes where branches are removed is not available.

Some growers tend to leave overlength terminal shoots (16-20 inches) the final year. Since trees are often sold by the foot, a few more inches may put the trees into a higher value class. Buyers are aware of this practice, however, and will only pay the value of trees with a particular leader length. This practice could also prove disastrous with pines if the trees aren't sold and must be carried an additional year. Overlength terminals on firs and spruces can be sheared after the Christmas season, but pines will need severe corrective pruning the following year.

The imaginary cone is easy to project on trees that have been sheared properly. Normally, the top laterals do not need special shearing, so the entire tree is sheared after the terminal is cut. Harvest-year shearing should only be used to remove overlength shoots that severely affect the balance of the tree. If the trees aren't sold, they can be lightly sheared one more year.

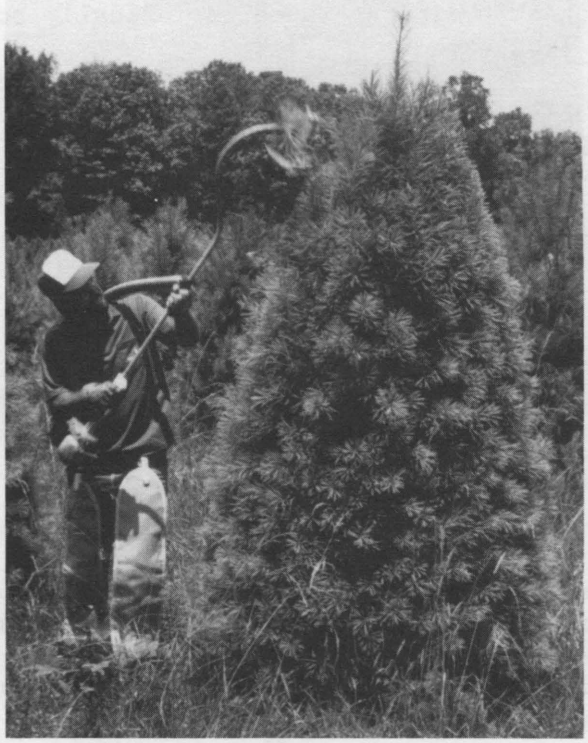

Figure 12. As trees approach harvest time, shearing should be light because they are already well-shaped and excessive shearing will give the trees an unnatural look.

Special Pruning Situations

Pruning Handles

When trees are sold, barren branches below the bottom whorl of foliated branches should be removed (Figure 13). This portion of the stem, the "handle," should be at least 6 inches long (plus a 2-inch stump) and shorter than 1.75 inches per foot of merchantable tree height (12 inches for a 7-foot tree). The first whorl above the handle should have at least three healthy well-balanced branches. Damage to this whorl can come from insects, disease, or mechanical equipment, and poor vegetation control can weaken the branches. If the bottom whorl is weak or asymmetrical the branches must be pruned off, raising the height of the base of the crown. When the tree is harvested the handles of graded trees cannot exceed the lengths recommended above, so removal of the bottom whorl requires a taller tree.

Figure 13. Grading standards require pruning lower branches to produce a "handle" on the stem.

Handles can be pruned when the trees are young (usually 3 years after planting), but many growers never prune handles. Growers who use cut materials for making wreaths, etc., often do not prune handles until just before harvest, using the pruned branches for cut materials. Some growers prune handles as the trees are harvested, but time restrictions during the harvest season make this practice difficult.

Pruning can be done any time of the year. Branches should be pruned as close to the stem as possible, otherwise a dead stub will be present. It is usually best to prune the handle as early as possible, when the trees are 18 to 30 inches tall. Branches are small at this time, little growth is removed, and small hand pruners can be used. If lower branches are allowed to grow large they compete with branches above, reducing their growth. These upper branches may be unbalanced, and when the lower branches are removed the bottom of the crown can be asymmetrical. Early pruning also facilitates keeping the area around the stem free of vegetation, decreasing favorable conditions for diseases, insects, and rodents.

Sometimes the lowest whorl of branches above the required handle height is weak or unbalanced (often from excess weed competition). This whorl must be pruned

off, requiring extensive foliage removal. Pruning should not remove more than 1/3 of the live foliage at one time. If more must be removed, the tree should be pruned in two stages, delaying the second pruning until the following year.

Corrective Pruning

Shearing trees that are "perfect" is relatively easy, but shearers never face fields of perfect trees. Depending on tree species, insect and disease pests, earlier shearing quality, and other factors, many trees need special corrective pruning. The extent of pruning on a tree can depend upon planned time to marketing. If several years from harvest, trees can be heavily pruned because future growth will cover the holes left by pruning. If approaching harvest, limit pruning to correcting only minor irregularities. Heavy pruning can extend harvest dates several years, which will result in harvests of larger trees.

Pruning removes new growth as well as old wood. When cutting into old wood, branches should always be pruned at a junction of a live branch (Figure 14), since bud formation on old wood is poor. Otherwise, dead stubs will form between the cutting point and the nearest live shoot. Sometimes corrective pruning involves only cutting into old wood; in these instances, pruning can be done any time of the year. Generally, however, pruning occurs during the shearing season since the entire crown is shaped at that time. Growers should always carry hand pruners, even in winter, for trees that need corrective pruning.

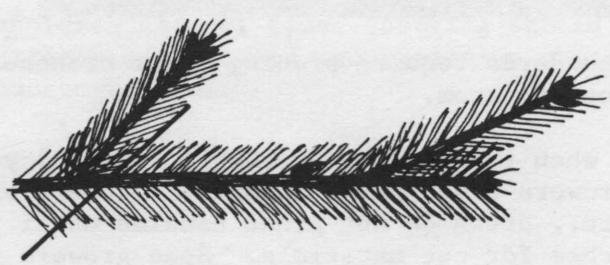

Figure 14. Cuts into "old wood" should be made at a junction with a live branch to avoid dead stubs.

Corrective pruning is done to provide a single dominant leader. Often, a lateral branch is "trained" to become a new leader, and competing branches are cut back to provide dominance for this leader. Training leaders, especially with current year's shoots, is best done when the shoots are succulent. These operations require some method for temporarily supporting the new leader.

Plastic flagging is commonly used to tie the new leader, using a supporting shoot. String, baling twine, and colored yarn are also used. After selecting a strong shoot in the center of the crown, tie the shoot as low as possible to a shoot directly opposite. Tightening the flagging pulls the shoot into an erect position (Figure 15). Cut the supporting shoot off above the tie (the remaining shoot will become a dead stub, which will fall off eventually).

Within several weeks the shoot should support itself. Some growers are concerned that leaving plastic flagging on results in injury to the trees, caused by a constriction on the stem as it grows. Although it appears constricting, many growers report no problems with leaving the flagging on. Biodegradable flagging which breaks down within a year is available.

Figure 15. Stem on tree several years after terminal shoot was straightened using the "supporting shoot" method (note tie-string and dead stub in center).

A metal wire device is also available for straightening leaders (Figure 16). The device is inserted on the tree using the stem for support, so removal of a lateral branch is not required. Several weeks later, after the shoots harden, the device can be removed for later use. Packs of the device can be painted with a bright color, or flagging can be tied to each wire, to facilitate finding them for removal.

Leaders may also be straightened by tying a stick to the main stem and tying the leader to the stick. Sometimes, if more than one year's growth is tied up, the new main stem is tied to the old stem. As with the wire device, it is not necessary to cut a lateral branch, but this process is time-consuming. It is only used when a large section of the stem must be straightened.

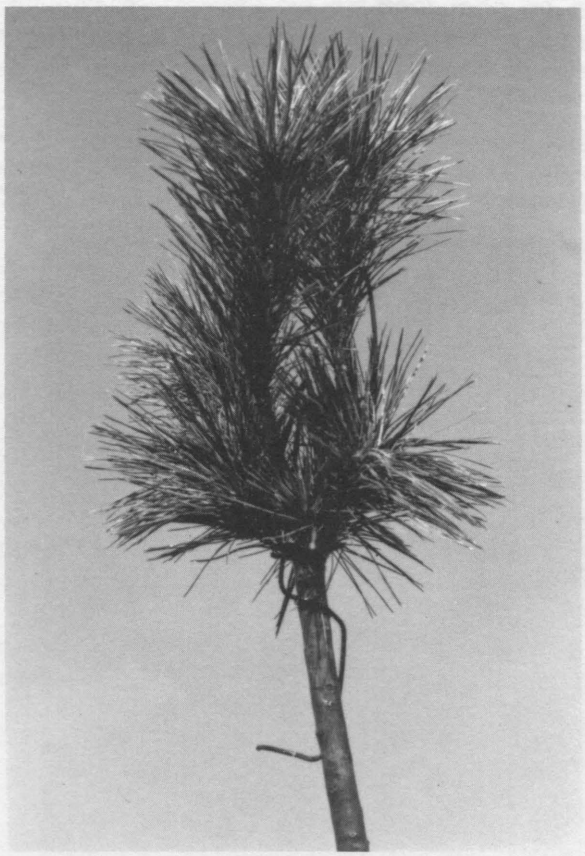

Figure 16. Wire support for straightening crooked terminal shoots.

Conditions requiring corrective pruning include:

Multiple Leaders - Since the shearing operation affects hormonal distribution and shoot dominance, trees will often form two or more stems that compete strongly to be terminals. If corrective action isn't taken, the tree will have two main stems, disturbing the symmetry of the crown and minimizing merchantability. A dominant leader must be selected and the competing shoot or shoots removed. If the tree is near harvest age, only part of the competing branch (at least the entire current year's growth) should be removed, since growth in succeeding years may not cover the hole left by complete branch removal. On trees that are at least two years from harvest, it is best to remove the entire branch to prevent further competition, especially if the branch competed with the leader in the previous year but was not pruned out. Usually it isn't necessary to tie up the leader on these trees.

Damaged or Missing Leaders - Frequently, insects, birds, or other agents damage the original leader, and a new leader must be trained to become dominant. Select a healthy leader near the center of the crown. If only this year's leader is damaged, straighten the new leader using the supporting shoot method or metal device described earlier. If last year's section of the main stem is damaged also, use the wire device to bring a lateral branch up, if possible, or

tie a lateral branch to the damaged main stem, cutting off the top of the damaged stem above the tie. It is important to shear competing laterals in the top whorl to ensure dominance by the new terminal.

If more than two years' growth has been damaged, it may be necessary to tie a stick to the main stem to support the new terminal. Trees damaged this badly often do not develop into merchantable trees because of the large crooks in their stems, especially if they are near harvest age. Sometimes a tree can be cut above the crook so that it will be saleable; but this often is not manageable because the remaining straight tree will not be tall enough. For example, if a crook is at 4 feet, a tree must be 11 feet tall to produce a 7-foot merchantable portion.

Over-Length Internode in Prior Year - If shearing was missed or improperly done in the previous year, an over-length internode can result, causing an open space in the crown. If the internode is less than 16 inches and the trees are less than 4 feet tall, the tree should grow enough by the time it's 7 to 8 feet tall to cover the hole. Older trees may have to be held additional years to provide sufficient growth to cover the hole. If the internode is much greater than 16 inches, pruning is required. Using procedures similar to those used when the previous year's growth is damaged, last year's and this year's terminal are removed, and a lateral branch (with shorter growth) is tied to a stick or the main stem. This procedure may work for trees that had two year's of shearing missed, but merchantability is limited as it is for damaged trees.

Excess Current Year's Growth - During some years, trees may experience exceptionally long terminal growth, sometimes 3 or 4 feet. This may result in few needle fascicles occurring below the bottom 12 inches of the leader. Since bud formation on pines only occurs at needle fascicles, few buds will develop if less than 4 inches of the leader remaining after shearing has needles. In this case, the original leader must be removed and a lateral shoot tied (or wired) up to form a new leader. Lateral growth is usually less than terminal growth, so an adequate-sized lateral should be present. Competing laterals must be cut back to allow dominance by the new leader.

Over-Length or Deformed Lateral Branches - Sometimes, when shearing along the imaginary line of the cone, old wood on a lateral branch extends beyond the line, requiring pruning the old wood. Old wood should be sheared at the junction of live branches, since any stem beyond the cut will result in a dead stub. If the tree is several years from harvest, it is often preferable to remove the entire branch. If a large number of branches must be cut into old wood, it is not practical to prune each branch, so the shearing tool cuts a path leaving many branch stubs. Substantial growth, perhaps several years, will be required to cover the stubs.

Poorly Formed Trees - Improper shearing in past years can cause misshapened or very thin trees. Such trees may recover after several years of intensive pruning, but harvest dates may have to be lengthened considerably. It often is best to remove these trees if they are few in number and would occupy the field for several additional years. If the grower produces wreaths or roping, these cull trees can be left unsheared and used for that purpose.

Frequently, a small percentage of trees have thin crowns (less than four branches per whorl). Growth is much poorer than that of surrounding trees, and needles are small and off-colored. Samples should be sent to your local Virginia Cooperative Extension Service office to determine if a disease or insect is causing the problem. If the trees are free of insect and disease, and it appears that growth will not be great enough to cover the thin crown, or each year the needles look poor, the trees probably have inherited traits (perhaps interacting with environmental factors) which prevent their becoming Christmas trees. It is best to remove them because further culture and shearing will be a wasted investment.

Summary and Further Information

Although shearing Christmas trees is both an art and a science, basic techniques to produce quality trees can be learned fairly quickly. By understanding the basic principles involved, shearers can adapt to differing conditions and imperfect trees.

Growers are encouraged to learn and practice their shearing skills far in advance of having trees old enough to shear. Shearing wild trees found on the property is a good way to practice without causing disasters in plantations. Sometimes, neighboring growers are willing to teach shearing techniques in return for a volunteer weekend or two of shearing on the neighbor's farm.

The Virginia Cooperative Extension Service (VCES), in cooperation with several groups and agencies, offers annual field demonstrations in June which include programs on shearing techniques. A videotape demonstrating shearing techniques is also available for sale or loan. Contact your local VCES office for further information.

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