



The Science of Shearing

BERT CREGG, PH.D. MICHIGAN STATE UNIVERSITY, DEPARTMENT OF HORTICULTURE AND DEPARTMENT OF FORESTRY

Horticulture is defined as the art and science of growing plants. Nowhere is the ‘art’ of culturing Christmas trees more apparent than in pruning and shearing. It seems nearly every tour stop at a Christmas tree meeting eventually devolves into a discussion/debate among growers; each espousing their philosophy and strategies for shaping trees. There are countless subtleties in how growers approach pruning and shearing, and there are innumerable ways to achieve a quality tree for a given farm’s customers. However, the artistic side of sculpting a tree into a shape desired by customers ultimately needs to be grounded in science and the biology of the tree itself. In this article, I’ll discuss some of the basic biology and underlying principles that guide the response of conifers to shearing. These fundamentals form the foundation that allow growers to express their creativity through culturing their trees.

Why shear Christmas trees?

Most conifers grown as Christmas trees naturally have a conical shape and symmetry that makes them attractive as Christmas trees. In some cases, depending on the species and customer preferences, growers may be able to market trees with little or no shearing. Typically, however, growers will need to prune or shear their trees. Nearly all growers prune trees for three principle reasons: to control growth rate (leader length), to increase tree fullness

(density), and to maintain tree symmetry (Fig. 1). Some growers will also basal prune their trees (i.e., remove bottommost branches). This is done to facilitate other operations as it makes it easier to mow and fertilize around trees. Basal pruning also makes harvesting trees easier and provides a handle for workers and customers to grab onto when handling cut trees. On the other side, growers that make wreaths or sell greenery may opt to not basal prune in order to produce additional bough material.

When to shear – know your species

One of the few absolute rules in shearing is that timing is critical and optimal timing varies among species. The differences in timing of shearing among conifer types is related to how buds form along the stem. For most conifers grown as Christmas trees, including spruces, firs, and Douglas-fir, shoots form a cluster of buds at the end of each shoot (terminal buds) and also

Figure 1. Shearing is the most valuable tool growers have to produce uniform, dense quality trees.



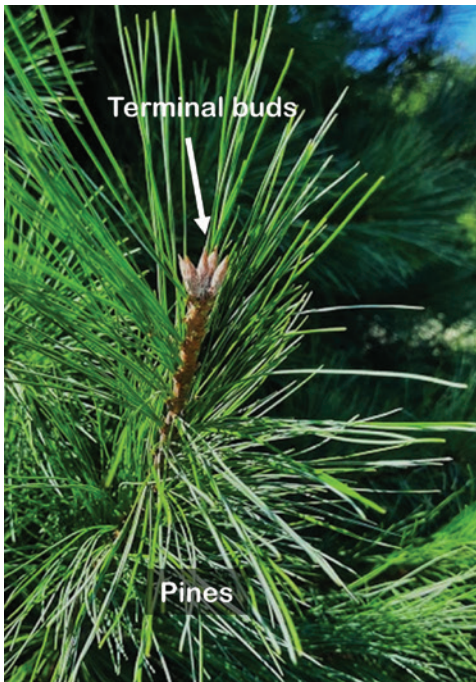


Figure 2. Pines (left) develop buds at the end of each shoot (terminal buds); whereas spruces, firs, and Douglas-fir (right) also develop buds along the stem (lateral buds).

form buds along each shoot (lateral buds) (Fig. 2). Trees in this group, which are collectively referred to as single-needle conifers, should be sheared *after* the current-year's leader growth is complete. For growers in the Great Lakes region, this means shearing trees in late summer or early fall. In theory, growers can shear single-needle conifers whenever the shoots are not actively growing, including during winter and early spring before trees resume growth. However, growers usually avoid this as weather is often unsuitable and research from NC State University indicates that earlier shearing (late summer/early fall) results in better growth and higher quality trees than winter shearing. In contrast, pines need to be sheared *during* the phase of active shoot growth. Unlike single-needle conifers, pines only form a cluster of terminal buds at the end of each shoot. If pines are pruned after the terminal buds are formed, they will not re-form new buds and growth will be lost. Instead, pines need to be pruned during shoot growth, referred to as the candle phase. The optimum time for shearing

pines is when the current leader growth is nearing completion. An easy way to judge this is to look at the length of needles on the current shoots – current-year needles should be about one-half the length of the existing needles from the previous year (Fig. 3). Shearing at this time will allow shoots to form a cluster of buds where the shoot was pruned, resulting in growth control and increased density (Fig. 4).

Pruning tools

The most common tools used to shape trees are shearing knives, hand shears, and hand pruners (Fig. 5). Many growers also use mechanical trimmers with either reciprocating blades or rotary blades (Fig. 6). The choice of pruning tools is one of those topics that can kick off a spirited debate among growers. However, the ultimate choice



Figure 3. The optimal time to shear pines is when the developing needles (top) on the current year's shoots are approximately half the length of the previous year's needles (bottom).





Figure 4. This Scotch pine was sheared in early June and has developed a full cluster of buds at the end of each branch by September.

is usually based on grower preference and experience, growers can produce quality trees using a variety of techniques. Regardless of the choice of pruning tools, growers should keep their tools sharp and clean. Keeping shearing tools sharp is important not only to ensure a clean cut rather than a tear, but also for worker safety as dull knives are more likely to catch on a branch during the shearing motion. Anyone who shears or prunes trees should always have proper PPE, including leg guards, eye protection, and gloves.

Maintaining a single leader

A key to achieving a straight and symmetrical quality tree is to maintain a single terminal leader throughout the tree's lifespan. The conical shape we normally associate with conifers is due to *apical dominance*. As the term implies, apical dominance is the control the terminal leader exerts over subtending shoots as the result of hormonal signals from the buds on the terminal leader that suppress the growth and development of buds below. Nonetheless, trees may develop a second



Figure 5. Dr. Mel Koelling, Michigan State University Professor Emeritus, demonstrates proper knife-shearing technique on a Fraser fir tree. Note the shearing stroke contours to the natural taper of the tree, the knife is swung away from the body, and hand pruners are used to adjust the length of the terminal leader, if needed. Leg guards should always be worn when shearing with a knife.



or multiple leaders. This can often occur once growers begin to trim the terminal leader to control growth as removing the terminal bud reduces apical dominance and stimulates development of lateral buds below. Normally a strong lateral bud will assume dominance, but multiple leaders may develop. These should be pruned out whenever they occur, even on relatively young trees.

Controlling leader length

Pruning terminal leaders to control height growth is one of the most critical decisions a grower makes each year

when pruning trees. If terminal leaders are left too long, trees can become leggy and thin; if leaders are trimmed too short, tree height growth is lost, and the tree may have to be grown another year to meet the desired height class. A common target for length of the terminal leader is 10-12", though the desired leader length varies with species and grower preferences. Some growers will allow young trees to 'stretch' and may prune leaders to 14-16" and then shorten the leaders in the 2-3 years before harvest. As trees approach harvest it is also important that the leader length

follow the overall taper outline of the tree. Growers that are experienced with pruning knives can accurately trim terminal leaders to the desired length with a shearing knife. However, using hand-pruners or extension pruners is a fail-safe way to achieve a desired leader length.

Taper

Taper refers to the overall shape of a tree and is expressed as the width of a tree relative to its height (Fig. 7). According to USDA Standards for Grades of Christmas trees, 'normal' taper can range from 40% to 100%, though most growers shear trees to a target of approximately two-thirds taper. This means a tree 6' tall, would be 4' wide at the base. Growers interested in growing tall trees (9' and greater) for homes and businesses with large ceilings, often seek to grow trees with a relatively narrow taper as increased width at the base adds greatly to the overall weight of the tree as well as the amount of floor space the tree will occupy.

When to begin pruning

"At what age should I begin pruning my trees?" is a common question among new growers and one that gets into the realm of the 'art' of tending trees. Experienced growers often take a 'hands-off' approach for the first 2-3 years after the planting. The key exception is pruning to remove defects, especially multiple leaders, which should be done any time they occur. By age 3-4, most growers will begin to control excessive height growth. The threshold length for pruning leaders varies by species, the quality of the leader, and the philosophy of the grower. Many growers will leave a 16" terminal leader on a young fir tree provided it has a good whorl of terminal buds. This will maintain tree straightness and symmetry better than removing the terminal and promoting development of a subtending lateral.



Figure 6. Shearing a large concolor fir with a rotary mechanical shearing tool.



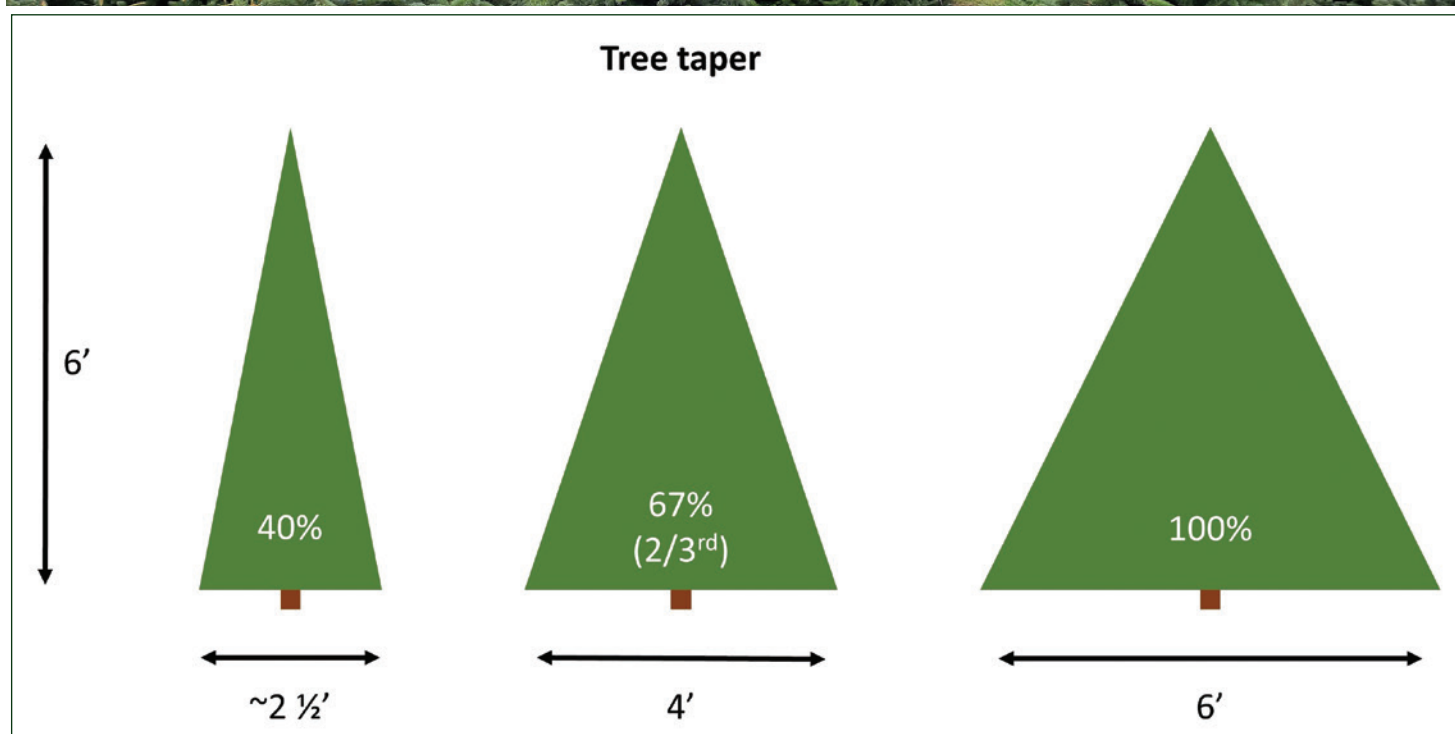


Figure 7. USDA Grading Standards specify ‘normal’ taper (ratio of tree width to tree height) as between 40% and 100%, although 2/3rd taper (67%) is typically considered desirable.

From age 4-5 and beyond, trees should be pruned regularly to maintain growth control, symmetry, taper, and to develop tree density.

Summary

As noted at the beginning of this article, pruning and shearing represent the greatest opportunity for growers to express their individuality and creativity and there are nearly countless tools, techniques, and philosophies that growers can employ to produce quality trees. Indeed, shearing can become a Zen-like pursuit to ‘become one with the tree’, and many growers derive their greatest satisfaction in tree farming from coaxing an elegant swan from an ‘ugly duckling’ tree. Regardless of the subtleties of a given farm’s shearing program, the ultimate goals of pruning – growth control, improving density, and maintaining symmetry and taper remain the same. In order to achieve these objectives growers need to have a thorough understanding of the underlying biological foundation behind shearing including differences in

species responses and the role of apical dominance in tree growth and development.

REFERENCES

- Hinesley, L. E., & Derby, S. A. 2004. Shearing date affects growth and quality of Fraser fir Christmas trees. *HortScience*, 39(5), 1020-1024.
- Hinesley, L. E., & Derby, S. A. 2004. Growth of Fraser fir Christmas trees in response to annual shearing. *HortScience*, 39(7), 1644-1646.
- Koelling, M.R. 1991. Shearing recommendations for Christmas tree producers. North Central Regional Extension Publication no. 310. 7 pp.
- U.S. Department of Agriculture. 1989. United States Standards for Grades of Christmas trees: Revised, effective 30 Oct. 1989. U.S. Dept. Agr., Agr. Mktg. Serv., Wash., D.C. [FR Doc. 89-23043]

BERKEY'S NURSERY

*“Growers of
Genetically Superior
Evergreen
Seedlings and
Transplants”*

**Go to our Website,
Write or Call for our
Complete Price List**

**44251 Rogers Road * PO Box 215
Spartansburg, PA 16434-0215**

**814-694-9200 or
814-654-7513**

www.berkeysnursery.com

All our plants are grown on fumigated ground!!