

# Tennessee Christmas Tree Production Manual



## Contributing Authors

### **Alan B. Galloway**

Area Farm Management Specialist  
agallow2@utk.edu

### **Megan Bruch Leffew**

Marketing Specialist  
mleffew@utk.edu

### **Dr. David Mercker**

Extension Forestry Specialist  
dmercker@utk.edu

## Foreword

The authors are indebted to the author of the original Production of Christmas Trees in Tennessee (Bulletin 641, 1984) manual by Dr. Eyvind Thor. His efforts in promoting and educating growers about Christmas tree production in Tennessee led to the success of many farms and helped the industry expand. This publication builds on the base of information from the original manual.

The authors appreciate the encouragement, input and guidance from the members of the Tennessee Christmas Tree Growers Association with a special thank you to Joe Steiner who provided his farm schedule as a guide for Chapter 6. The development and printing of this manual were made possible in part by a USDA specialty crop block grant administered through the Tennessee Department of Agriculture. The authors thank the peer review team of Dr. Margarita Velandia, Dr. Wayne Clatterbuck and Kevin Ferguson for their keen eyes and great suggestions.

While this manual is directed more toward new or potential choose-and-cut growers, it should provide useful information for growers of all experience levels and farm sizes.

Parts of the information presented will become outdated. It is recommended that prospective growers seek additional information from their local University of Tennessee Extension office and from other Christmas tree growers.

# Contents

- Chapter 1: Beginning the Planning** ..... 5
  - Timely Labor and Management Required ..... 5
  - Location ..... 5
  - Size of Operation ..... 6
  - Layout ..... 6
  - Grower Survey ..... 7
- Chapter 2: Site Selection** ..... 8
  - Soil ..... 8
  - Climate and Microclimate ..... 9
  - Existing Vegetation ..... 9
  - Farm Access, Layout and Utility Needs ..... 9
  - Proximity to Markets ..... 10
- Chapter 3: Site Preparation** ..... 10
- Chapter 4: Planting** ..... 11
  - Seedlings and Transplants ..... 11
  - General Planting Observations ..... 11
    - Dibble or OST Bar Use ..... 12
    - Auger Use ..... 12
    - Replanting ..... 12
- Chapter 5: Species Selection** ..... 13
  - Pine ..... 13
  - Fir ..... 15
  - Spruce ..... 16
  - Cypress ..... 16
  - Other Species ..... 18
- Chapter 6: Tree Farm Schedule of Activities** ..... 18
- Chapter 7: Insects, Diseases and Weeds** ..... 20
  - Insect Control ..... 20
  - Disease Control ..... 23
  - Weed Control ..... 25
- Chapter 8: Shearing** ..... 26
  - Shearing Basics ..... 26
  - Shearing Equipment ..... 29
  - Basal Pruning ..... 29

**Chapter 9: Marketing** ..... 30

    Marketing Fundamentals ..... 30

    Christmas Tree Farm Marketing Strategies ..... 31

    Additional Resources ..... 35

    Summary ..... 36

**Chapter 10: Equipment Needs** ..... 36

**Chapter 11: Economics of Production** ..... 38

**Chapter 12: Records, Taxes and Insurance** ..... 46

    Income Tax ..... 46

    Sales Tax ..... 47

    Insurance and Risk Management ..... 47

**Chapter 13: Grower Tips** ..... 48

    Planting and Growing Tips ..... 48

    Shearing Tips ..... 49

    Marketing Tips ..... 49

## Chapter 1: Beginning the Planning

Growing and selling Christmas trees can be an enjoyable and profitable agricultural enterprise with proper planning, timely labor activities and successful marketing and management.

Like all agricultural enterprises, it is best to start by gathering as much information as possible. The main purpose of this manual is to provide the prospective Christmas tree grower with a basic understanding of the process involved in growing and marketing Christmas trees successfully. Any person seriously considering Christmas tree production should review this manual and obtain additional information from other sources. By visiting current Christmas tree farms during both the selling season and the off season, prospective growers can observe a variety of production and marketing methods and designs of farm layouts. By noting what works well and could be improved upon at each operation visited, a new grower will be better able to design their layout for efficient production and marketing. Observing a farm during the sales season provides insights on customer service, parking and other logistic issues, and sales methods. Visiting when the farm is not actively selling trees allows the farm owner more time to discuss the pros and cons of their operation and share suggestions of value to a new grower.

### Timely Labor and Management Required

A successful Christmas tree farm is highly dependent on the labor and management activities involved in production. Christmas trees do not simply grow on their own; a reasonable amount of labor is required. Growing Christmas trees involves a multiyear production cycle with a variety of jobs required during the growing process to ensure a high-quality, marketable product. Since most labor activities can be scheduled, a small tree farm can fit well as a part-time farming enterprise. While it is not expensive to begin the process of buying seedlings and planting them, the timely care of those seedlings during the early years is critical to success. The more significant equipment needs of a choose-and-cut Christmas tree farm arise in the year sales begin, as suggested in the economics chapter. However, those purchases will not be necessary unless proper shearing, weed and grass control, and insect and disease management have occurred during the growing of the trees.

### Location

The location of a Christmas tree farm can significantly impact initial planning, potential size, marketing and profitability. A choose-and-cut tree farm located near a more populated area has a larger potential market and generally easier accessibility to the farm. Unfortunately, the cost of land near towns and cities may be prohibitive. Locating a farm a few miles outside a city can be an advantage in promoting the farm. Owners can market it as being a short drive or escape from the city. While an easy-to-find location is preferred, good signage and advertising can overcome many obstacles to an out-of-town location. Locating the trees near the parking area allows employees to easily greet and direct customers. Consider the proximity to competing Christmas tree farms because established farms have a returning customer base and a new farm will be competing for any new customers in the area. Studying the population within a reasonable distance to the farm may aid in predicting the potential sales.

Many farms provide additional experiences such as wagon rides to the tree cutting area. The additional cost of equipment and labor for such activities must be considered along with any potential liability



involved. The space for roadways, parking and sales buildings should be accounted for early in the planning of the overall farm layout.

The quality of the soil, slope of the land, and layout of the farm will impact the cost and labor required to grow the trees. While the soil can be amended with lime and fertilizers, learning to shape trees growing on a slope is a bit more challenging. More severe slopes also impact mowing and spraying the trees.

Shading in the tree patch is also a consideration. In shaded areas, growth is often slower and shearing may need to be enhanced to provide a high-quality tree. Although some varieties tolerate shade, most varieties grow best in full sun. If large forest trees are located near the east, south or west sides of the trees, growth may be impacted. Establishing rapidly growing varieties like Virginia pine in the shade causes less growth on the shaded side, making the tree more open or thin-looking and possibly unmarketable.

## Size of Operation

Available acreage, planned total number of trees and layout of the operation all factor into the number of seedlings planted each year to determine the size of the operation. If acreage is limited, a tighter spacing between rows and trees in each row can increase the number of trees per acre. More about tree spacing is covered in Chapter 2.

One common mistake made by new growers is planting too many seedlings during the first couple of years. For example, if a farm has plans to grow a total of 5,000 trees, dividing 5,000 by five or seven years and planting 700 to 1,000 seedlings the first year may not be advisable. Two major reasons for starting out with a smaller number of seedlings are marketing and management. Newly planted seedlings usually take five to seven years to become marketable trees. Initially, a lower number of trees may be sold than are ready for sale. Marketing and advertising (signage, word of mouth, print and internet) for several years will help growers develop a customer base and repeat customers.

Planting a smaller number of seedlings during the first couple of years is recommended. Increase the number planted during the third and subsequent years. Growers are often surprised in the third to fifth year of sales when sales increase substantially. In the early years, a grower is learning proper care and maintenance of the young seedlings. Weed and grass control around young seedlings is essential and shearing can be overwhelming as the trees reach the third to fifth year of growth. Planting a smaller number of trees initially allows the grower time to learn proper care and improve their shearing technique.

## Layout

Careful consideration of the layout of the trees and parking area and the location of sales buildings, all should be considered before planting begins. When planting, consider how the customers will be directed to the patch or area of trees for sale. Open areas or walkways to each block of trees can help direct customers away from small seedlings and younger trees. Walkways also help customers as they carry/transport their cut tree back to the baling, netting and loading area. Growers can make walking through the trees easier by planning the direction of the rows properly. Customers walking through tightly spaced rows may cause damage to unsold trees.

The parking area should be very clearly marked. Good signage is vital, especially if customers are directed to park in a grassy area. Most drivers are accustomed to paved or at least graveled parking areas and will often block roads or walkways unless directed otherwise. Allow for overflow parking! Realize most choose-and-cut farms sell 80 percent or more of their trees during the first two weeks of sales. Traffic is greater on Saturday and Sunday of those weeks.

## Grower Survey

In 2015 a survey was conducted of primarily choose-and-cut Christmas tree growers to determine a variety of production information. Some of the results gleaned from the completed surveys are outlined below.

The most prevalent species grown in East and Middle Tennessee based on the number of farms growing each species included:

1. White pine
2. Norway spruce and 3. Canaan fir (tie for second)
4. Leyland or Murray cypress
5. Blue spruce
6. Virginia pine and Scotch pine (tie for sixth)

Other species grown include Fraser fir, Concolor fir, Nordman fir, White spruce, Serbian spruce, Meyer spruce, Turkish fir, Manchurin fir, Douglas fir, Momi fir, Eastern hemlock and Niko fir.

Most of the other species were grown in fairly low test quantities to observe growth traits and marketability.

West Tennessee has a smaller number of growers and fewer species grown. Most growers noted that the hotter climate of West Tennessee limited the species that could be grown.

The species reported as more prevalent in West Tennessee were:

1. Leyland or Murray cypress
2. Virginia pine
3. Arizona cypress (Blue Ice or Carolina Sapphire)

Other species grown in western Tennessee included White pine, Scotch pine and Red cedar.

The survey allowed the growers to identify the most common insect and disease problems encountered. Those are addressed in this manual. The percentage of seedlings planted versus the number sold each year was identified. Allowing for seedling mortality and trees that simply do not become marketable, Tennessee Christmas tree farms average selling between 50 to 70 percent of all seedlings planted.

## Chapter 2: Site Selection

The conditions of the land to be planted should be evaluated early in the process of developing and managing a Christmas tree farm. Christmas trees are a crop, and as with any agricultural crop, must be well-suited to the existing land. Very little can be done to alter the site and its conditions. Therefore, trees should be selected based on the best available knowledge of their site requirements. For growers without extensive knowledge in this area, advice from experts is vital, including Extension agents and specialists, foresters, soils scientists, or possibly agronomists and horticulturists.

A planting “site” includes all of the environmental attributes within the area that contribute to vegetative growth. Growers should know both the favorable and limiting characteristics of their site(s). Often, Christmas tree sites are selected because the land is considered not productive enough for other farm products. Poor sites can produce Christmas trees, but good sites will produce better ones.

### Soil

Evaluation of a planting site begins with soil analysis. Specifically, the primary considerations include depth, texture/drainage, pH and fertility.

#### Depth

Soil depth refers to the rooting zone. It is the distance between the soil surface and an impenetrable layer below the surface. Impenetrable layers can include a hardpan, rock ledges or, in some instances, a high water table. The deeper the rooting zone, the more favorable the growing conditions. On dry sites, shallow soils lead to limited growing space and available water. As trees become larger, demand for water increases and shallow soils become problematic. Thus, deep soils will generally hold (and make available) more moisture and nutrients.

#### Texture and Drainage

Soil texture refers to the proportion of the primary soil components: sand, silt, clay and minerals. Soils with high clay content tend to have high moisture and fertility retention, limited rooting, and are often very poorly drained. In contrast, soils with high sand content offer better rooting, but drain quickly and are prone to drought. Because Christmas trees are a relatively short-rotation crop (relative to other tree crops), most varieties can grow sufficiently for a typical five-to-seven-year rotation on a variety of soil textures. However, internal drainage, especially when extremely rapid or slow, can greatly hinder tree growth (and even establishment). Land that is too steep prevents water percolation and retention, which can lead to erosion and make planting, maintaining, and harvesting difficult. Sites with good internal drainage are preferred.

#### pH

Soil pH is the measure of acidity or alkalinity in the soil. Soil pH is very important for conifer nutrition, more so than fertilizer in many cases. Christmas trees perform best when soil pH ranges from 5.5-6.0. A proper pH range allows for better nutrient absorption; therefore, the pH should be tested before fertilizing. Urea, ammonium nitrate and ammonium sulfate can be applied to lower the pH level.



## Fertilization

Fertilizing can improve growth rate and tree color, however it can be expensive, so there is no point in applying more than is needed. A soil analysis is recommended prior to planting, then every three years thereafter.

## Climate and Microclimate

Expanding more than 400 miles and 6,000 feet in elevation east to west, Tennessee's regional and more localized climate varies considerably, as well as the climate of very small areas, according to slope aspect (direction a slope faces) and slope position (upper, middle or lower).

Selection of trees to plant varies both regionally and locally. For instance, regionally, spruce and fir Christmas trees are better adapted to the higher elevations in East Tennessee, while Leyland cypress performs better in West Tennessee. Virginia and Scotch pines generally outperform white pine on drier west-facing slopes, especially in East Tennessee.

## Existing Vegetation

The selection of a planting site must also address the existing vegetation. Plants already on or absent from a site often indicate site conditions. Sparse vegetation might suggest a low pH or fertility, whereas indicator plants (for instance scouring rush, Pennsylvania smartweed or yellow nutsedge) could reflect poor internal drainage. In addition, existing vegetation will determine the amount of site preparation needed prior to stand establishment. A cover of grasses would require a different site preparation approach than would an area of woody plants.

For best results, clean planting sites are preferred. Often, many sites selected for Christmas tree production are fallow fields and pastures or poorly performing row crop fields. Clean sites can limit seedling damage resulting from feeding small mammals (rabbits, voles), thus eliminating their habitat. However, exposed sites, particularly adjacent to woodlands, may attract deer. Deer damage results from both feeding on buds as well as antler rubs on stems.

## Farm Access, Layout and Utility Needs

Although they do not affect tree growth, access to the plantation as well as the layout and the utility needs are important to the logistics of growing and selling trees. They are part of the *site*. Good access for equipment and customers (in choose-and-cut operations) is essential. This includes well-drained roads and lanes, parking and proximity of the trees to all customer areas. Water, electricity and restroom facilities may be needed — all are factors for safety as well.

Layout in part is determined by the amount of land (acres) available and the type of equipment to be used to maintain (mow) the tree patch. A 5-by-6-foot spacing (5 feet between trees by 6 feet between rows) is recognized as the closest reasonable spacing. A mature 7-foot-tall tree should be about 60 percent as wide as it is tall, or about 4.2 feet wide. Properly sheared Christmas trees in a 5-by-6-foot spacing will almost touch at 7 feet tall (more about shearing is covered in Chapter 7). If no open areas are left for walkways or driveways, a 5-by-6-foot spacing provides 1,452 trees per acre. A more open spacing is recommended for providing more sunlight for tree growth, to allow space for larger/taller trees, to minimize possible

damage by mowing equipment, and to provide better access for customers and workers. The following table shows the number of trees per acre for each spacing with no allowance for open areas.

Feet Between Trees		Feet Between Rows	Trees per Acre
5	X	6	1,452
6	X	6	1,210
6	X	7	1,037
7	X	7	926
7	X	8	777
8	X	8	680
8	X	9	605

## Proximity to Markets

Whether a choose-and-cut or wholesale business model, a tree farm located close to buyers increases the number of potential customers and reduces marketing costs. Choose-and-cut operations, farms located at the urban interface, will attract more customers simply because of convenience. Although not as vital to wholesale growers, proximity to potential buyers reduces transportation and advertising costs — the closer, the better.

## Chapter 3: Site Preparation

Many factors must be considered when establishing a Christmas tree farm. Aside from proper site and species selection, suitable preparation of the planting site is central for survival, early growth and overall success.

Site preparation practices may include burning, spraying, disking, draining, raking, subsoiling, fertilizing, pH amending and more. The purpose is to modify the soil, litter or existing vegetation and thereby make the microclimate surroundings more favorable for the growth of seedlings. Site preparation should be well thought-out and thoroughly implemented long before the seedlings arrive for planting.

Competition for environmental resources can be keen and originates from seed banks, perennial plants and seeds deposited during or after planting. An often overlooked source of competition and damage is mammals, both small and large. Voles, rabbits and deer forage on roots, cambium and new growth. Eliminating their habitat, if such species are perceived destructive, is a key component of site preparation.

Site preparation activities vary according to the pre-existing vegetation conditions and are grouped by these common situations:

- Fields currently in row crops.
- Fallow crop fields containing herbaceous weeds.
- Crop fields — multiple years fallow containing persistent woody species.
- Pastures (primarily fescue-dominated, well- or minimally maintained).
- Timber harvest areas.

Addressing broad and specific site preparation techniques is outside the scope of this publication. However, a thorough publication was developed in 2009 covering many aspects of site preparation. Although the publication focus is on hardwood tree plantings, the site preparation techniques are similar. Refer to the following for more information: UT Extension publication PB 1783, "Site Preparation and Competition Control Guidelines for Hardwood Tree Plantings" ([extension.tennessee.edu/publications/Documents/PB1783.pdf](http://extension.tennessee.edu/publications/Documents/PB1783.pdf)).

## Chapter 4: Planting

Proper planting is essential to provide each seedling or transplant a chance to become a premium quality marketable Christmas tree. Christmas trees on most Tennessee farms are planted by hand using either a dibble or OST (old standard planting) bar or by using an auger/post-hole digger. A few larger farms use a tractor pulled transplanter. This section reviews types of seedlings and planting methods.

### Seedlings and Transplants

#### Bare Root Seedlings

The majority of Christmas trees grown in Tennessee begin as a bare root seedling obtained from either the Tennessee Division of Forestry Nursey or from private nurseries selling Christmas tree grade seedlings. Some Christmas tree farms grow their own seedlings or transplants; and a few make them available for sale to other farms. Bare root seedlings are typically sold by the age and growth method. For example a 2-0 seedling has been grown for two years in a seedling bed and a 3-1 seedling would have been grown for 3 years in a seedling bed and one additional year in a transplant bed. Generally the older, larger seedlings will cost more. Christmas tree growers must analyze whether the higher cost is justified. Most growers plant 2-0 or 3-0 seedlings of most species.

#### Container Grown Seedlings

Some nurseries grow transplants in small containers with potting mix either in trays or individual fiber containers. The cost of containerized seedlings is generally higher and growers must balance the cost and whether the survivability is improved using such seedlings.

Species like Leyland and Murray cypress, Blue Ice and Carolina Sapphire (Arizona cypresses) do not produce seed and must be grown from cuttings. These cypress trees are often sold in small 2-by-2 inch peat pots or larger transplants in 1 gallon pots. When buying smaller seedlings survivability in the field may be improved by planting the small seedlings into a transplant bed for six months to a year before transplanting them to the field. The larger size and better root development enhances the chance of survival and continued growth.

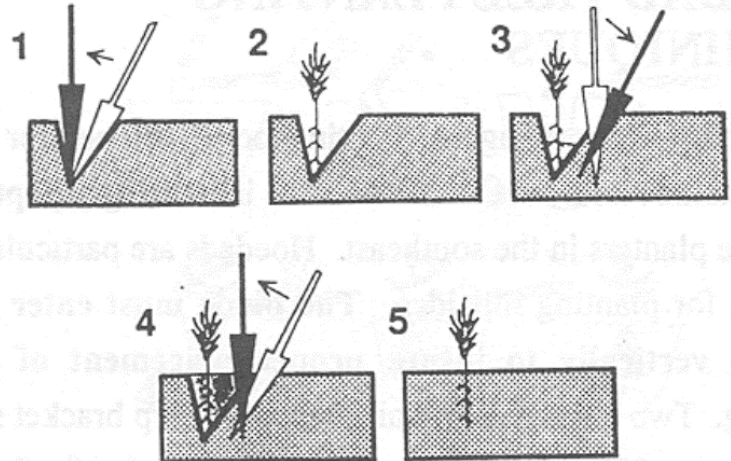
### General Planting Observations

All seedlings no matter the species, should be planted close to the same depth as they were grown in the nursery. Planting too shallow allows roots to be exposed. Seedlings can be planted slightly deeper (1' to 1.5"). However, planting too deep may decrease survival. Seedling roots should never be allowed to dry out prior to planting. Store all seedlings upon receipt in a cool area away from direct sunlight. It is not recommended to place them in a bucket of water as this excludes oxygen to the roots and might decrease

survival. Watering immediately after planting also helps to ensure sufficient moisture for the new seedling and helps eliminate air pockets in the soil which might allow roots to die. A good pair of knees pads are recommended.

### Dibble or OST Bar Use

As the diagram shows the bar should be inserted straight vertically into the ground and leaned toward you. Place the seedling in the hole with all roots in the hole pointed downward. If the main root is curled upward (referred to as J rooted) survival and future growth is decreased. Place each seedling gently to the bottom of the hole and then pull up until the proper planting depth is obtained. Insert the bar a few inches further away from the seedling and push toward the seedling, closing the soil around the roots and the top of the ground. Verify the seedling is straight and adjust by hand or by reinserting the bar if needed. Pressing or stepping on the ground helps ensure closure of the soil around the seedling and prevents air from reaching the roots. Seedlings often have long tiny fibrous roots. A small portion of these can be broken or cut off to expedite planting without impacting survival.



When creating the initial hole, rocking the bar side to side tends to create a larger hole with a wide top and bottom while narrow in the center. Rocking the bar makes planting easier, but also makes it difficult to close the soil completely around the roots without having to insert the bar on both sides of the seedling.

### Auger Use

Planting using a motorized one-man, two-man or tractor driven auger is slightly more time consuming. However, the larger hole may provide for better root development and better growth during the first few years after planting. Additional good quality top soil is often needed to refill the hole if the auger disperses the soil too widely to recover. If the soil contains much clay, the sides of the hole dug by the auger may appear hard and shiny. In such cases, use a screwdriver or other sharp tool to score the sides of the hole before planting to make root penetration easier. Pack the soil firmly around the seedling to eliminate air pockets and to prevent settling of the seedling below ground level after watering or rainfall.

### Replanting

Some percentage of the seedlings will not survive and replanting may be required to fully utilize the land. Depending on the availability of new seedlings, it may be a few months or even the following year before replacements can be obtained. This may cause some trees in the block to mature a year or more after the original planting.

When planting into an area where mature trees have been cut and the stumps remain, seedlings can be planted between the stumps. Farms with limited land often have mixed age trees in the same area. Planting between the stumps aids in keeping the spacing similar and in keeping the row straight. Planting

between a stump and a nearly mature tree is not advisable as the mature tree will shade the seedling reducing growth. Stumps of most species (especially pines) will rot within a couple years and are easily removed. If a third crop is planted in the same place where a stump has been there is a possibility of rotting wood eating insects to be present in the soil. Check the soil in advance of planting and treat with an insecticide if needed. Planting a different species also helps to reduce the possibility of insect and disease problems. Growing staggered age trees in the same area does make management difficult and increases potential insect and disease damage.

## Chapter 5: Species Selection

A wide variety of Christmas tree species have been grown and sold successfully in Tennessee. The primary determinants for species selection are the site conditions (including elevation, moisture, soils, residual vegetation, etc.), the market desires, and the management needed to grow a top-quality marketable tree. Some species are traditional favorites, such as pines and firs, whereas others are newer and gaining in popularity, such as cypresses.

Before establishing a Christmas tree plantation, speak to other local growers and inquire about species adaptability from Extension personnel and professional foresters. In this section, a number of species will be discussed, focusing on general observations/experiences of growers and site requirements.

### Pine

#### **Virginia Pine — *Pinus virginiana* Mill.**

For years, Virginia pine has been a commonly grown Christmas tree in Tennessee. It is native to the Appalachian region, where in its natural state it grows on a variety of sites. Within Tennessee, it is native to the eastern half, plus smaller pockets northwest and southwest of Nashville. As a lumber tree, it is undesirable, having a poor form and grade. However, as a Christmas tree, it performs well, and its rapid growth allows for a quick-to-market product. This species can become a premium 6-to-7-foot tree in as soon as five growing seasons with proper management. Typically as seedlings, Virginia pines are less expensive, making it cost-effective for new growers. It requires intensive management, including shearing and pest control. Also, the foliage is less green than other species, and colorant is needed to make attractive trees. Their odor is favorable.

Because of its rapid growth, Virginia pine requires shearing twice per year during the last three growing seasons. It is very shade-*intolerant* and should be planted in full sunlight without morning or afternoon shading effects. A 7-by-7-foot spacing is recommended to avoid self-shading and to encourage rapid growth. This rapid growth is necessary to minimize losses because the species is highly susceptible to many insects and diseases and may require regular spray applications throughout the growing season.

Site requirements — Virginia pine is an adaptable tree, capable of growing on a wide range of sites. Do not plant this species in soils that are severely nutrient-depleted, shallow, excessively dry or wet, or with impeded drainage. It tolerates a wide pH range (4.6 to 7.9). Virginia pine is shallow-rooted and is

susceptible to loss or excessive lean due to wind or heavy snows. Sites exposed to high or excessive wind should be avoided, and removal of heavy, wet snow is recommended.

### **Scotch Pine — *Pinus sylvestris* L.**

Scotch pine is common to many Christmas tree farms in Tennessee. The species is native to Europe, where it grows in natural stands throughout that continent. It is the most widely distributed pine in the world. Because Scotch pine is introduced, this species has not developed a strong resistance to some pests. It is susceptible to a number of diseases, including needle blight, needlecast, needle rusts and cankers. Problematic insects include sawfly, webworm, weevil and scale. Further, in the case of the short-needle varieties, winter injury can occur. Dead needles within the branches can be both difficult to remove and add weight. On fertilized sites, color retention is fairly good. The tree is also aromatic.

Shearing is conducted once during the growing season. Timing varies according to tree age and size. Shearing should not begin until the new growth has set bud. This date can vary by elevation and year to year. Begin by shearing young trees first, then advance to older trees and eventually to those trees that will be sold during the current year. Shearing that begins too early in the growing season can lead to llamas shoots. Llamas shoots are a second flush of foliage that sometimes occurs if available moisture is high later in the growing season. However, shearing conducted too late will prohibit proper bud formation and can lead to deformed growth during the next growing season. Timing of shearing is very important!

Normally shearing does not begin until the third growing season, and is conducted initially to control excessive height growth. Twelve inches is customary for annual height elongation. Less than 12 inches leads to overly dense, heavy trees; growth greater than 12 inches may lead to foliage gaps. As trees become taller, shearing to control side growth becomes necessary. By the third or fourth growing season, Scotch pine will require both top and side shearing.

Site requirements — The Scotch pine is highly adaptable and can tolerate a wide range of climates. It can endure temperature and moisture extremes, making it a well-adapted Christmas tree species across all sites in Tennessee. In its natural range, it grows amid ancient rocks, yet is found on young soils derived from glacial and alluvial deposits. Further, Scotch pine is highly capable of extracting nutrients from depleted soils. Due to needlecast diseases, saturated soils should be avoided, as should sites with high humidity and cool temperatures, such as northern and eastern slopes.

### **Eastern White Pine — *Pinus strobus* L.**

White pine is a grower's choice throughout most of Tennessee and a good species to plant to offer customers variety. It is favored by many consumers in that it is less dense, lighter and does not retain large quantities of expired needles. Tennessee is at the southernmost location of the natural range, specifically the higher elevations of East Tennessee. It has been widely planted ornamentally, leading to naturalization in many portions of the state. Because Christmas trees are a relatively short-rotation woody crop, this species can be grown in West Tennessee. However, it performs poorly with maturity in the Western region, succumbing to heat and drought. Shearing practices should follow the regime of Scotch pine. Flexible branches and soft needles allow this species to be sheared easily.

Site requirements — White pine prefers a cool and humid climate, such as northern and eastern slopes. It is considered fairly tolerant to frost, shallow soils, drought and shade. White pine grows in a variety of



soils, but best performance is on well-drained, sandy soils. Do not plant this species in poorly drained bottomland sites, heavy clay soils, or hot and dry western or southern slopes. Excessive heat and extended drought will kill trees.

## Fir

### Fraser Fir — *Abies fraseri* (Pursh) Poir

Fraser fir has gained in consumer popularity, particularly within wholesale markets. It is the only fir species native to the southern Appalachian Mountains, and even there its presence is limited. Fraser fir does not grow aggressively, requiring seven to 10 years to produce a marketable size. Seedling cost is generally higher than with the pines, and with its higher fertility demands, affects profitability.

Site requirements — In its natural state, Fraser fir grows in cold, moist climates and in mountainous areas exposed to frequent fog. It is not suited for most sites in Tennessee, particularly those below 2,000 to 3,000 feet in elevation, with best growth occurring above 5,500 feet.

Fraser fir is not tolerant of shallow soils or drought, is moderately tolerant of frost, but is considered shade-tolerant. As such, it is best suited for northern and eastern slopes. Clay soils and soils with poor internal drainage should be avoided due to susceptibility to root rot. Because of these specific site requirements, this species is limited to mostly the few counties of highest elevation in eastern Tennessee. Often the remote sites suitable for growth of Fraser fir make accessibility for choose-and-cut operations difficult.

### Balsam Fir — *Abies balsamea* (L.) Mill.

Balsam fir is a species that is occasionally grown for use as Christmas trees in Tennessee. In the natural setting, it ranges from upper Minnesota eastwardly to New York, then north through Maine. It is present in very minor amounts in the Virginias, but does not grow naturally in Tennessee.

Site requirements — Balsam fir prefers cool climates with a mean annual temperature of 35 to 40 F with 30 to 43 inches of mean annual precipitation. These preferences apply to mature trees, not those grown on a short rotation such as Christmas trees. It cannot tolerate hot, dry summers, so it is not recommended for growing below 2,000 feet in elevation. Even at higher elevations, growers should plant it sparingly.

### Canaan Fir — *Abies balsamea* var. *phanerolepis* (Fern.)

Canaan fir (pronounced “Ka-naan,” with emphasis on the last syllable) provides an option for growers at lower elevations in eastern and middle Tennessee. The Canaan fir variety of the balsam fir was first identified in the Canaan Valley of West Virginia. They are similar to the Fraser fir with slightly longer needles and a lighter underside. Growers should not plant a high percentage of Canaan fir because of its low growth and sensitivity to diseases like root rot. However, their popularity and higher selling price makes them a reasonable species to grow. It may take 9 to 10 years to achieve a 7-to-8-foot marketable tree. Buying an older seedling or transplant may shorten rotation and reduce the percentage of death loss. Smaller Canaan seedlings are sensitive to water needs (both too little and too much). Expect a higher seedling mortality and replanting needs for Canaan fir, compared to pines and spruces.

Site requirements — Planting in well-drained soils is advisable to reduce root rot potential. Due to later bud break, Canaan fir will grow at elevations below 2,000 feet. Growth is slow at 6 to 10 inches per year,

and good soil nutrition is essential. Because of higher average temperatures, Canaan fir is not a viable choice for farms in southern Middle and West Tennessee.

## Spruce

### **Blue Spruce — *Picea pungens***

Blue spruce is not a commonly grown Christmas tree within Tennessee, although it is occasionally added in plantations to offer customers variety. The bluelike needles can be attractive to some; however, consistency in color is hard to achieve. It is found naturally in the western United States, where it grows in the central and southern Rocky Mountains. Growers often avoid it because of the slow growth rate. Consumers enjoy the lighter foliage color of blue spruce, but dislike very sharp needles.

Site requirements — Blue spruce typically grows in humid, cool environments characteristically found at 6,000 to 9,000 feet in elevation. Although the tree prefers abundant moisture, it is capable of withstanding drought and very cold temperatures. Soil preference varies widely. In natural stands, the species performs well in soils derived from weathered bedrock, alluvial deposits and glacial deposits. The typical soil pH of such sites is nearly neutral, 6.8 to 7.2. Within Tennessee, blue spruce is recognized as not growing well below 2,000 feet in elevation because of warm temperatures. About half of the growers in East and Middle Tennessee still include a small percentage (2-5 percent) of blue spruce on their farms because of its popularity with some customers.

### **Norway Spruce — *Picea abies* (L.)**

Norway spruce is native and widespread in Central and Eastern Europe. It has been introduced around the Northern Hemisphere, including the US where it was used early for windbreaks. Unlike the pine species, Norway spruce is tolerant of shade, making it a possible choice to grow along existing tree lines. It is also resistant to many pests. Norway spruce is a low-maintenance choice, requiring little shearing and colorant. Branches have a drooping appearance, to some resembling an old-fashioned look. It may require a few years longer to produce a marketable tree. A major drawback of a choose-and-cut Norway spruce is it does not retain its needles as long as pine trees, making it unfit for extended periods indoors. For this reason, many growers refrain from selling them until after the first of December.

Site requirements — Norway spruce can be grown throughout the state as a short rotation woody crop, but long-term, it prefers a moist, cool climate and northern slopes. Poor or dry soils should be avoided. It performs best in the Cumberland Plateau eastward.

## Cypress

### **Leyland Cypress — *Cupressocyparis leylandi* (also Murray Cypress)**

Leyland cypress is a unique species in that it is a genetic cross between the Alaska-Cedar and the Monterey cypress. Both of these are native to the North American Pacific Coast. There are several cultivars of Leyland cypress; some are better adapted to the Southeast. The tree is commonly planted in yard settings as a fast-growing, visual screen; however, because this species is highly susceptible to several diseases, it is no longer recommended for plantings intended to last more than seven years.

Leyland cypress grows very rapidly, is low maintenance, and produces a consistent product. Also, because of the natural green color, colorant is often not needed. Other favorable traits include it is highly insect- and disease-resistant (during early growth only), has a straight growth form, bales easily, causes few allergy problems, and very little shaking is required to remove dead needles. Planting cost, however, is higher than most other species because the seedlings are rooted stock instead of seed germinants. In addition, Leyland cypress does not enter into dormancy as quickly as other species, continuing to grow during the early winter season. As such, it requires considerable water after harvest — a problem for the wholesale market.

Site requirements — Because Leyland cypress is a genetic cross and therefore is not native, the natural range cannot be addressed. However, Leyland cypress can tolerate a wider range of sites in pH and soil drainage than can many other Christmas tree species. It is shade-tolerant. The primary site limitations are susceptibility to prolonged drought and excessive cold (including temperatures below 0 F). High temperatures do not seem to affect its growth, provided natural or irrigated water is available.

In Tennessee, temperatures around 10 degrees below zero have caused significant damage to even larger Leyland cypress. Damage is typically seen when tips of limbs became frozen and younger seedlings die. Multiple nights of similar temperatures can expand damage to entire limbs. Larger Leyland cypress, especially trees in landscape settings, may exhibit what appears to be a dieback of limbs 6 to 12 inches out from the trunk. Continued shearing of surviving Christmas trees may still provide a marketable tree, though it may take a couple of extra years of growth and shearing to accomplish.

There is no species difference between Leyland and Murray cypress. The Murray cypress is a cultivar of Leyland cypress which is recognized as originating from cuttings propagated at Southern Christmas Tree Farm near Cordele, Georgia. The farm owner, William Murray (deceased), recognized some Leyland cypress trees having a darker color and growing more vigorously. In the years since, many seedling producers and Christmas tree farms throughout the South grow and sell Murray cypress.

### **Arizona Cypress — *Cupressaceae arizonica***

Arizona cypress is a tree that is native to the southwestern US. The most common varieties sold are the Blue Ice and Carolina Sapphire. It is sharply steeple-shaped, with very tiny and plentiful pale green to gray or bluish-green leaves. The tree is substantially drought-, heat- and cold-tolerant, but has low shade tolerance. Little maintenance is required. Shearing is done mainly to reduce vertical growth to enhance side limb growth. Light shearing of side limbs is required to obtain the desired shape and density. Similar to Leyland cypress, the Arizona cypress is sensitive to temperatures below zero. Many customers enjoy the citrusy aroma of the Blue Ice. However, some are sensitive to the more pungent aroma of the Carolina Sapphire.

Site requirements — Arizona cypress grows naturally on rocky, mountainous slopes with dry, sterile and thin soils. Although it can tolerate such sites, it grows very rapidly in fertile, moist, but well-drained soils. Arizona cypress is not suitable in Upper East Tennessee at elevations above 3,000 feet, nor on poorly drained soils or those with a high water table. The occurrence of diseases increases in areas of high humidity, including mistletoes and rusts. The attractive foliage makes it a potential choice as a living Christmas tree.

## Other Species

A number of other species are grown in Tennessee. The success of these species has varied widely due to climate and soil conditions. Although many farms attempt to grow a few of the rarer species, most grow the standard, common species. Some of these rarer species include the following:

**Firs:** Concolor fir, Nordman fir, Turkish fir, Manchurin fir, Douglas fir, Momi fir, Meyer fir and Nikko fir.

**Spruce:** White spruce, Serbian spruce

**Others:** Eastern hemlock and Red cedar

## Chapter 6: Tree Farm Schedule of Activities

The following activity schedule provides a guideline for the many functions undertaken annually on a Tennessee Christmas tree farm. The actual timing of many activities will vary based on the varieties of trees grown, location in the state and weather.

### January

1. Check for bagworms; remove and destroy them.
2. Saw off any tall stumps remaining from the selling season and grind stumps.
3. Plant bare root white pine, Scotch pine, Virginia pine (possibly some varieties of firs).
4. Plant some seedlings (like Turkish fir) into 1-gallon pots for field planting in fall.

### February

1. Continue or complete white pine planting.
2. Purchase Leyland cypress, Murray cypress, Blue Ice and Carolina Sapphire (1-gallon pots), or if purchasing smaller Leyland cypress, transfer smaller seedlings to a plant bed or to 1-gallon pots for later field planting. (Note: These varieties can also be planted in the fall between September and November.)
3. Prune/shear Leyland cypress (anytime between January and June).
4. Stake or tighten soil around Leyland cypress to straighten.

### March

1. Complete planting of Leyland cypress.
2. Fertilize growing trees. Some growers apply one-third to two-thirds of total annual fertilizer in the spring with the remainder later in the spring or in the fall. The early spring application is the most important if only one application is performed each year.
3. Spray fungicide on Leyland cypress and Scotch pine if needed.

4. Apply pre-emergent weed control if being used.
5. Basal prune trees, especially those more than 2 years old.

#### April

1. Apply glyphosate for weed control if pre-emergent is not used or to control missed weeds.
2. Mow/control grass especially around younger seedlings (1 to 2 years old).
3. Order any seedlings to be planted in the fall. This activity could be done earlier to ensure availability.
4. Plant seedlings ordered from northern sources (PA, MI, etc.).

#### May

1. Mow to control grass.
2. Apply insecticide to control bagworms as needed. In early spring years this may need to be done in April.
3. Apply second part of annual fertilizer application.

#### June

1. Mow grass.
2. Prepare all tools for shearing.
3. Check for insect problems and apply insecticide as needed.
4. Begin shearing Leyland cypress, Blue Ice, Carolina Sapphire and Virginia pine.

#### July

1. Shear white pine.
2. Complete first shearing of Leyland cypress, Blue Ice, Carolina Sapphire and Virginia pine.
3. Check for insect problems.
4. Order any precut trees (e.g., Fraser fir) to be sold in fall.

#### August

1. Prepare areas to be planted in the fall and next spring — spread fertilizer and lime according to soil test. Lay out rows, spray glyphosate in strip to be planted.
2. Order white pine and/or Virginia pine seedlings from state nursery.
3. Update website and plan for advertising.
4. Repaint/replace signage if needed.

#### September

1. Apply fall fertilizer application.
2. Recheck shearing tools for fall shearing.

3. Purchase and plant species to be planted in the fall.
4. Shear (second shear) Leyland cypress, Virginia pine, and touch up others as needed.

#### October

1. Apply tree colorant prior to first major frost.
2. Planting other fall seedlings.
3. Clean/de-vine all trees to be sold this year.
4. Prepare patch for selling season, remove overgrown trees, fill holes, and check for any potential dangers to customers.
5. Purchase seasonal advertising.
6. Plan for and secure additional labor needed.
7. Check saws, pruners and other tools used in selling process.

#### November

1. Complete fall planting.
2. Prepare sales building/facilities, set up equipment (baler, shaker, etc.).
3. Set up additional signage.
4. Improve directional signs as needed.
5. Begin selling trees.

#### December

1. Sell trees.
2. After selling season, clean up and store equipment.
3. Make notes of good and weak points about selling season to guide improvements next year.
4. Cut and grind stumps.

## Chapter 7: Insects, Diseases and Weeds

### Insect Control

Potential damage from insects in Tennessee Christmas tree plantations is less than in many states. Frequent inspections are necessary. Prompt spraying with recommended insecticides or other control measures must be initiated before an infestation spreads and becomes difficult to control. The inspections aid in determining the severity of infestation (how many trees are infested and the amount of damage on each tree). Most insect damage is observed during the shearing of the trees. When an infestation is minor or limited to a few trees, it may be advisable to mark (not shear) those trees and treat them before shearing. Often, spot spraying an insecticide on a few trees is sufficient to control the infestation. However, control measures can include removal and burning of infested trees. Following are some



common Christmas tree pests and control measures. There may be a number of possible chemicals used to control a variety of insects. Any chemical mentioned in this manual should be verified if it is still a recommended product. Always carefully follow the directions for the use of any pesticide.

## Bagworm

A survey of Tennessee Christmas tree growers revealed the common bagworm causes the most damage on Tennessee farms. The wingless, grub-like, adult female bagworm lives within the tough protective cover of her bag. Shortly after mating, she lays 500 to 1,000 eggs, which will remain in the bag over the winter. One effective control is to remove the bags prior to spring and burn them. Between mid-April and late May, the eggs will hatch and the larvae will begin feeding. The larvae spin their own bag that protects them as they move while feeding.

Often, one can observe a heavily infested tree appear to be quivering as the small larvae (about ½-inch long) begin chewing on the needles from their tiny bags. At this point, an insecticide for controlling chewing/feeding insects is needed to prevent significant damage. If spraying is delayed until the larvae and their protective bag is large, it is more difficult to obtain effective control. If spraying does not provide control, the bags should be removed by hand and destroyed. One non-insecticide commonly used to control bagworms is *Bacillus thuringiensis* (Dipel). Some insecticides currently labeled for bagworm control include acephate (Orthene), carbaryl (Sevin), cyfluthrin, malathion and permethrin.



Bagworm, Photo courtesy of USDA (bugwood.org)

## Pine Bark Adelgid

The pine bark adelgid (previously called a pine bark aphid) is very common on white pine plantations. The adelgid is tiny and covered with a white woolly wax. Heavily infested trees appear to be whitewashed. Adelgids feed on the stem, the underside of branches and new growth at the base of needles. Small trees may be badly stunted, while larger trees can have reduced growth.

In the spring, females lay eggs that hatch into nymphs, which then develop into winged and wingless females. The wingless forms remain on the host and may produce five or more generations. Some of the winged females fly to other trees to lay eggs.



Pine Bark Adelgid, Photo courtesy of USDA (bugwood.org)

Heavy infestations of pine bark adelgids are difficult to control. Due to thick foliage and the adelgid's nature to be underneath the needles and limbs, a directed stream with sufficient force should be sprayed. Control measures include spraying with dormant oil before growth starts in the spring. Treat only when temperatures will remain above 40 degrees F for 24 hours following spraying. Cyfluthrin and Imidacloprid insecticides or insecticidal soap may assist in controlling major infestations.

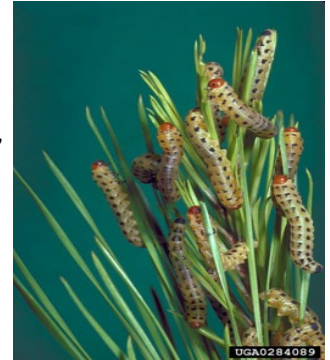
## Balsam Twig Aphid and Balsam Woolly Aphid

The balsam twig aphid is a very small insect often covered with a white cottony material. Damage can often be seen on Fraser fir in the spring when the limb tips curl upward. Twig aphids need to be controlled early in the spring before needles are severely curled.

The woolly aphid is a threat to stands of large fir trees. They have two generations each year. Once the crawler begins feeding, it covers itself with “wool” and never moves again. Initial symptoms include gouting of buds and twig nodes. Numerous chemicals can be used for control; some control has been obtained using insecticidal soaps. The woolly aphid should be sprayed while in the crawler stage for easier control. A spray using a forceful stream may be needed when either aphid is covered.

## Sawfly (Redheaded, European and Introduced Sawflies)

The sawfly has a green wormlike larvae, about 1 inch long. It feeds on older needles which results in the tree having a thin appearance. Given the opportunity, the redheaded sawfly can completely defoliate trees, making them unfit for sale. On small Virginia and Scotch pine seedlings, sawfly larvae can strip all the needles in a few days. Check trees of all ages in the early to mid-growing season; small clusters can be knocked off and crushed; larger concentrations require insecticide applications. Sevin, Malathion, Orthene or other labeled insecticide should be effective.



Red Headed Sawfly Larvae, Photo courtesy of USDA (bugwood.org)

## Nantucket Pine Tip Moth

Adult Nantucket pine tip moths lay eggs on new shoots that become deformed by larvae feeding, which often results in trees becoming unattractive for sale. Feeding occurs under a small, tent-like web. If the outbreak is light and random, prune and destroy the injured shoots. Shearing can remove infested shoots if the damage is on the shoot terminal; larger concentrations require drenching with registered insecticides.

## Pales Weevil

Pales weevil is a continuing problem with Christmas trees, especially where periodic harvesting leaves fresh stumps. Females are drawn to stumps for the fresh pine resin in which they lay eggs. Pales weevil larvae tunnel into and feed on the roots, while the adults feed on the bark. Tree and seedling mortality caused by these pests can be extensive. The pales weevil is found mostly on white and Scotch pines and occasionally other species. Cut stumps must be removed or drenched with a registered insecticide to kill egg-laying adults if the site will be planted the following year. Otherwise, allow cut areas to be fallow for one growing season before replanting.

## Pine Needle Scale

All pines and most spruce trees are susceptible to pine needle scale. A white, waxy coating (called scale) covers adult insects as they suck sap from the needles. The result is weakened trees with sparse, discolored foliage, rendering them unsellable. Eggs overwinter beneath these minute scales (about 1/10 the size of a grain of rice) and emerge in the spring.



Pine Needle Scale, Photo courtesy of USDA (bugwood.org)

Control by pesticide can be challenging due to the protective scale. Cut and remove infested trees, being careful to carry — not drag — them through the plantation so as not to spread the scale. Dormant oil can be applied in late fall through early spring to smother the eggs; larger infestations can be sprayed or soil drenched with a labeled insecticide.

### **Webworm**

The webworm larvae can kill, stunt or deform pine Christmas tree seedlings by eating needles. Affected needles and the production of unpleasant webbed nests can render a tree unsellable. The larvae's outcastings remain in the nests. Webworms are very heavy feeders, enlarging their nest as they feed, with as many as 70 larvae per nest. Cut, remove and destroy small concentrations. Larger infestations can be sprayed with labeled insecticide.



Pine webworm, Photo courtesy of USDA (bugwood.org)

### **Pine Spittlebug**

Pine spittlebug attacks all conifers but prefers white and Scotch pine. Heavy infestation can stunt or kill shoots as the feeding activity clogs the tree's vascular system. This pest is typically recognized by the foamy or bubbly spittle masses on small branches. Eggs hatch in spring and the nymphs begin feeding and producing the frothy spittle. Often light infestations do little damage. Heavy infestation may require insecticide sprays. Spraying while the spittle masses are present is the most effective time of application.



Spittlebug, Photo courtesy of USDA (bugwood.org)

## **Disease Control**

The possibility of diseases in Christmas tree plantations always exist. There are a number of diseases that can weaken trees and reduce growth. Proper planting and care can significantly reduce losses. Vigorously growing trees are less susceptible to disease. Reduced vigor may be caused by low fertility, drought, poor drainage, insect attacks, herbicide injury or mechanical damage. Always match the species with the site; provide adequate soil fertility; control insects; and avoid damage from herbicides, mowers and tractors. Sanitation is critical in reducing the occurrence and spread of diseases. Growers should remove dead branches, high stumps and any diseased/infected trees. Even in well-managed plantations there can be outbreaks of infectious diseases. Early detection and control with appropriate treatments are essential. The diseases described below are some of the more common in Tennessee.

### **Phytophthora Root Rot**

This fungus disease is associated with poor internal soil drainage. Some species are more susceptible than others to developing it. Canaan fir and Fraser fir are quite susceptible, and Norway spruce and white pine also can be susceptible in poorly drained sites. In parts of middle and eastern Tennessee where annual rainfall may exceed 60 inches and soils are slow to drain due to high clay content, root rot type diseases

can occur easier. The mountains where Fraser fir is grown also experience lower average temperatures and high relative humidity, often compounding problems from root rot.

Root rot occurs on trees in clay soils or on shallow sandy soils underlain with clay or rock. Needles of affected trees will first develop a light green color. In late summer these needles will turn brown, especially if subject to water stress. Roots of the infected trees have a reddish-brown color with few white growth tips.

In the field, chemical control with fungicides is typically not practical. If trees are in their last year prior to sale, fungicide use might minimize damage. Damaged, infected trees should be removed. If possible do not replant in the diseased area. Take measures to prevent transfer of the soil to other parts of the farm.

### **Needle Cast/Needle Rust**

Needle cast diseases are some of the most common diseases encountered by Christmas tree growers. Species susceptible to such diseases should not be planted in areas where morning sunlight is limited or in areas prone to fog and heavy dew. A wider spacing of trees may factor into reducing needle cast type diseases. Removal of seriously infected trees is key to preventing spread of the disease. Use of fungicides does not eliminate the disease. However, their use can aid in preventing further infections. The timing of the fungicide application may vary for each disease. Determining the appropriate time to apply fungicides is critical to their effectiveness. When replanting even a disease free area, it is wise to change species to help prevent outbreaks.

Some of the more common needle cast diseases are:

- Lophodermium needle cast, Dothistroma needle cast, Cyclaneusma needlecast and Sphaeropsis tip blight are common to Scotch, Austrian and red pines.
- Rhizosphaera needle cast is commonly seen on Colorado (blue) and white spruce.

Symptoms include yellow to brown rings or halos on needles in late spring or early summer. Needles will turn yellow and then brown sometimes with a reddish tint during the fall and early winter. Needle drop can cause large open areas in the tree rendering it unsellable. Trees will often look healthy during the early growing season when the symptoms are minor and when spraying should occur. By fall when the needles are turning brown it is too late for effective fungicide application. If infected area on tree is small, pruning out damaged limbs and spraying early next year might allow regrowth to occur.

Typical fungicide application is needed during the spring to early summer period while the new growth is occurring. By verifying the type of needle cast present the timing and frequency of spraying can be fit to improve effectiveness.

### **Pine Stem Rusts**

A common stem rust is eastern gall rust, which occurs on Virginia and Scotch pines. The disease causes the formation of round to oval-shaped galls. The galls often deform stems and branches. The infected areas are sometimes invaded by wood-rotting fungi as a secondary problem. Infection begins in the current year's shoots. A year later, a swelling develops at the point of infection. Recommended control is to prune

and burn branches that have galls. Pruning early in the tree's life (2 to 3 years old) can still allow sufficient time for regrowth to occur and provide a marketable tree.

## **Cankers**

Seridium and Bot canker can impact Leyland and Murray cypress. Pitch canker is common to pines. These diseases are more common in older stands and may not affect young Christmas trees. A fading or yellowing of a twig or branch may be the first symptom, as the fungus invades the branch through a wound. The canker may ooze resin and the branches may turn gray in color. The fungus is spread through splashing of water or pruning tools. Sanitation is the best defense from cankers. Prune out and remove any disease twigs and limbs by cutting on the trunk side of the diseased area, and clean pruning tools often to prevent spread of the fungus. Removal of the whole tree may be necessary if the canker has spread to the trunk.

## **Weed Control**

A weed commonly is defined as a plant growing where it is not wanted. To the grower, often weeds are valueless, troublesome and potentially expensive to control. Weeds are problematic by impeding proper tree development and by hindering management (such as shearing, pruning, coloring or harvesting). Weeds and grass with their roots in the upper few inches of the soil use moisture/water that would otherwise be available for tree growth. Two methods of controlling weeds are employed in Christmas tree production: mechanical and chemical.

**Mechanical Weed Control** — Mowing is a very effective means of controlling unwanted vegetation. Growers should not be overly concerned about landscape-type mowing. The purpose is to assure the survival of young seedlings, prohibit competition with lower branches, reduce habitat for damaging mammals and improve access for management activities. There is no set timing for mowing, rather it should occur as needed and as the annual weather pattern dictates. A general timeline is early season to minimize competition, mid-season to aid in shearing activities, and late season for harvesting. Some weeds are not effectively controlled by mowing, particularly those that grow between trees and are missed in the mowing process. This can include hardwood sprouts. Further, while mowing can suppress some weeds, it can release others. Mowers hitting and damaging trees may cause wounds allowing insects or diseases an entry point. Mowing too close and rubbing tires of the mower on lower limbs may remove needles and make a tree less desirable.

**Chemical weed control** — There are many advantages to chemical weed control. Chemicals are applied for many of the same reasons as mowing; however, chemical applications typically last longer and are less expensive. Chemical weed control normally occurs early in the growing season, and mid- and late summer applications are only applied as needed. Herbicides allow young tree seedlings the opportunity to overcome competition from unwanted vegetation and thereby capture the site.

The most commonly used weed and grass herbicide at Tennessee Christmas tree farms is glyphosate (Roundup). Numerous pre-emergent and post-emergent broadleaf and grass herbicides are also available. Most herbicides must be applied only to the weed or grass and contact with the limbs of the Christmas trees must be avoided. A few chemicals allow spraying over the trees. Carefully follow all label directions



for chemical use and personal protection when applying chemicals. Labels are specific and penalties expressed. Not following the written instructions for herbicides is a federal offense, subject to fines.

Herbicides aid in preparing the site for planting, controlling weeds upon planting, and eliminating invaders after planting. Christmas tree production is assisted through the use of herbicides and would drop dramatically if herbicides were not available to tree farmers. Herbicides are relatively nontoxic to humans and animals, and only then at extremely high rates that far exceed manufacturers' recommendations.

## Chapter 8: Shearing

### Shearing Basics

Proper and timely shearing is critical to having a high-quality, marketable Christmas tree. Some species or varieties are more forgiving than others, meaning the trees might recover from poor or late shearing. This section is a basic guide on timing and methods of shearing.

Climate variations across the state and each year's growing conditions impact the growth and best time to shear. Proper shearing manages vertical growth and holds back the faster growing southern side of the tree, allowing the northern side to fill in to create a beautiful, well-branched, symmetrical tree that customers desire. Shearing is a learned art and one area where personal instruction from an experienced grower can be beneficial and is highly recommended. CAUTIONS: New growers should always be cautious when learning to shear. Make sure no person or pets are nearby. A misplaced swing of a shearing knife or motorized shearer can easily cut through clothing and even boots. Leg protection (chaps or leg guards) should always be worn and steel-toed boots are recommended. Never attempt to lean the top leader over by hand while shearing the top whorl of limbs. Use a stick or similar item (about 24 inches long) to hold the top leader to the side while shearing the upper whorl of limbs. Eye protection is recommended especially when operating motorized shearing tools.



Eastern White Pine—prior to shearing, Photo courtesy of MARK 4 Christmas Tree Farm

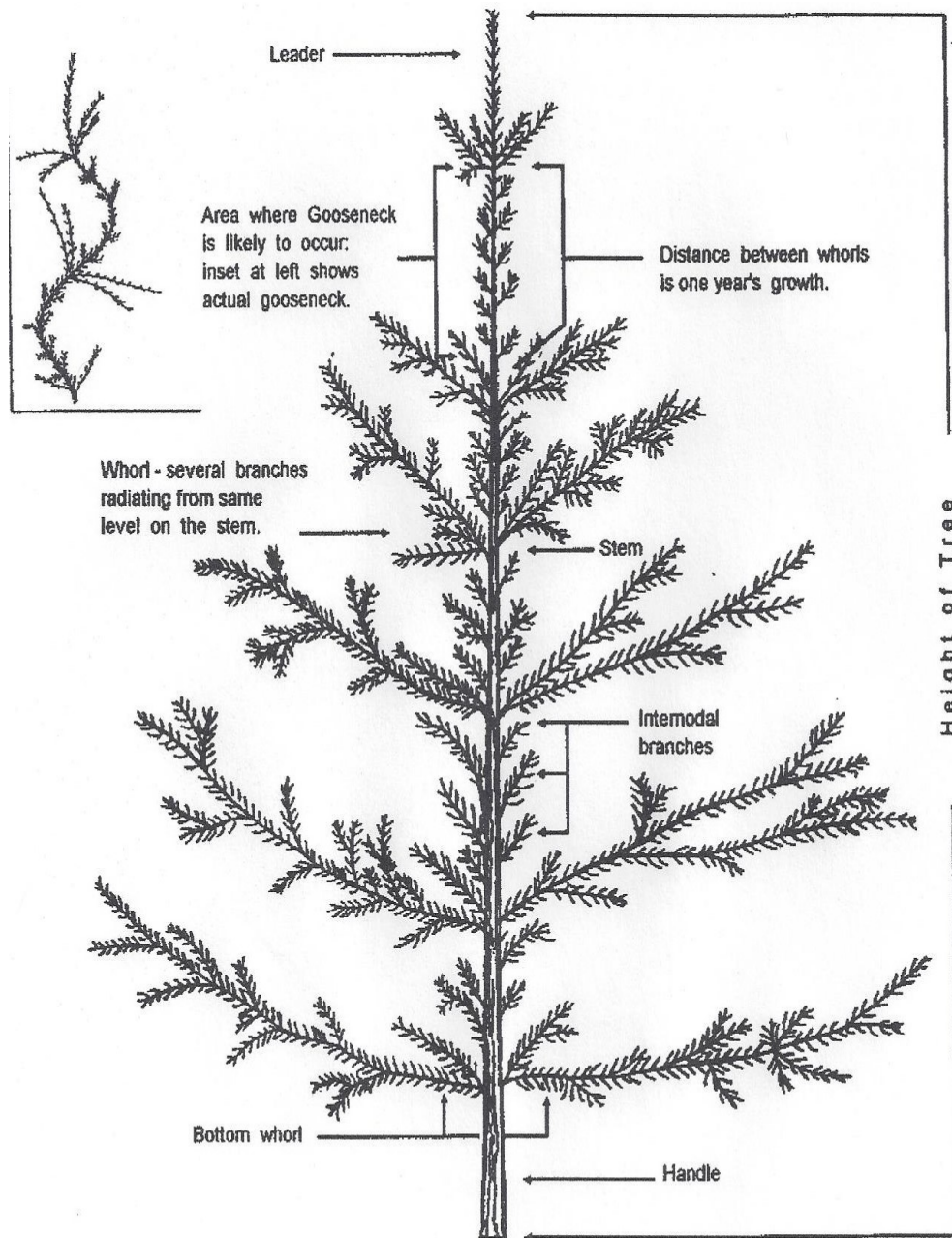


Eastern White Pine—post shearing, Photo courtesy of MARK 4 Christmas Tree Farm



The desired shape or taper of a Christmas tree is about two-thirds of the height (60 percent). This would mean a 6-foot-tall tree would be about 4 feet wide. A narrow (candlestick shape) of 40 percent or less taper and a wide 80 percent taper are not popular with most customers. The recommended shape of spruce and fir trees are easier to maintain when sheared properly and at the right time. White and Scotch pine tend to be wide naturally if not sheared tight in their early years of growth. Most customers are accepting of slightly wider pine trees.

During the first couple years of growth, shearing is generally limited to simple work with a hand pruner or shears to remove double trunks and double leaders (tops), trim back wayward growing lateral (side) limbs, and to train a new leader should one be broken or damaged. The following are some general recommendations for different species.



CHRISTMAS TREE TERMINOLOGY

## **White Pine**

The typical calendar window for shearing white pine in Tennessee is mid-June to mid-July when the vertical growth is complete and the new needles are three-quarters of the length of older needles. Shearing too early will cause regrowth in the later part of the summer that can cause future shearing challenges. Shearing too late, especially if the new growth has hardened off too much, will cause the tree not to set new buds for the next year's growth. Generally the vertical leader should be pruned at a 45 degree angle to about 12 to 14 inches. This causes next year's row of new limbs (whorl) to sprout to create a thick, well-branched tree. When a central leader is damaged or missing (often due to birds or insects) it may be necessary to tie two limbs in the top whorl together to encourage one of them to become the central leader. The remaining side limbs should be sheared to create and maintain the narrow pyramidal shape. If the side limbs are not sheared properly in the early years the result will likely be a wide, rounded tree (sometimes called a shouldered or bullet-shaped tree). Shear only in the new growth. Shearing in the old growth on white pine will cause a lack of regrowth and leave open sections without foliage on the tree.

## **Scotch (Scots) Pine**

Shearing is very similar to white pine. Scotch pine should be sheared following white pine as they can withstand a little later shearing. The vertical growth of Scotch pine is typically less than white pine. During early years, shearing side limbs tight can prevent short, wide trees. Similarly, shearing an older tree too tight makes the limbs very dense and thereby difficult for customers to hang ornaments in the tree.

## **Virginia Pine**

While white and Scotch pine are only sheared annually, Virginia pine typically requires two shearing per year, and occasionally a third, to achieve the desired shape and density. The rapid growth of Virginia pine can provide a marketable tree one to three years faster than white and Scotch pine. Virginia pine should be grown in full sun. The first shearing of Virginia pine should occur in mid-May to mid-June before white pine. A second shearing will depend on the growing season but usually occurs in late August to mid-September. The multiple shearings help the fast-growing tree to fill-in and prevent crooked limbs from growing toward the south side.

## **Norway Spruce and Blue Spruce**

The timing of shearing for most spruce varieties is not quite as critical. They generally can be sheared after the pine shearing season (after July in most areas). Other than early corrective pruning, shearing begins typically the third year after planting. Make sure there is a strong central leader and the side limbs are sheared to maintain the proper taper or narrow pyramid shape. Care should be taken to only shear where there is needle growth on the limbs. Regrowth will be limited if cutting back to bare limb areas inside of where needles are growing.

## **Leyland and Murray Cypress**

Due to the rapid growth of Leyland and Murray cypress, two shearings per year are necessary. Often a late spring (late May to early June) shearing to maintain a good central leader and control side growth is followed by a fall shearing in late August into September. The cypress' ability to withstand heavier shearing makes it more forgiving to mistakes and accidental overshearing. The more frequent shearing results in better strength in the outer limbs for holding ornaments. More openly sheared cypresses tend to have weak wispy limbs.

## **Blue Ice and Carolina Sapphire**

These varieties of Arizona cypress have excellent vertical growth and will need to be sheared similar to Leyland cypress. If needed, retard vertical growth by shearing at least twice a year. By maintaining a good central leader and lightly shearing the side limbs to promote more growth, these varieties can provide excellent and unique trees.

## **Canaan Fir (And Other Firs)**

Due to the slow growth of Canaan fir when grown in the non-mountainous areas of East and Middle Tennessee, shearing is relatively simple. The first three years after planting often require only corrective pruning to prevent multiple leaders or unusual side growth. Shearing can be done almost any time of the year. Shearing in late summer (August-September) is preferred to shorten the primary leader, promote proper tree shape and aid in setting new growth buds for the following year. Some growers follow-up with a shear while trees are dormant during winter to make corrections and touch up prior to the growing season.

## **Shearing Equipment**

Most growers begin with a good quality pair of hand pruners and a shearing knife (plus leg protection). As more trees are planted and the number being sheared increases, many move up to a motorized shearing tool like the string trimmer type (Beneke) or a backpack type (Saje) shearing tool. No matter what type of tool is used, it must be sharp to provide the clean cut needed to help the tree sprout more vigorous growth. A rough or jagged cut tends to reduce the quality and amount of regrowth. Hedge type shears (manual or powered) may not provide a clean, smooth cut and could negatively impact regrowth. See the Equipment section (Chapter 9) for more information.

## **Basal Pruning**

Basal pruning is another step in the tree shearing process required to ensure a high-quality final product for customers. To basal prune use hand pruners or another tool to create the “handle” at the bottom of the tree trunk by removing the lower limbs. A proper “handle” of 8 inches to 12 inches makes a tree more attractive, easier to cut and provides trunk length to place the tree in the customer’s tree stand. Basal pruning should typically be done during the tree’s third year of growth. Pruning too early in the tree’s life removes limbs needed for photosynthesis and growth. Waiting too late in the growth or until the year of sale will allow lower branches to become large and removal will often leave an open area in the lower branches lowering the overall quality of the tree. Basal pruning should never remove more than 25 percent of the tree’s limbs.

## Chapter 9: Marketing

Marketing is vital to the potential success any business, including Christmas tree enterprises. Many drivers of profitability are influenced by various activities associated with marketing including managing costs, production quality and efficiency, pricing for profit, achieving some minimum level of sales volume, building repeat customers, and managing risk.

### Marketing Fundamentals

When thinking of marketing, people often consider a single aspect or two, typically advertising or sales; however, marketing is actually much broader than these two activities and includes:

- An analysis of the market.
- Identification of target audience(s).
- Development and implementation of market strategies including products offered, product positioning, price, promotion, place or method of distribution, and people/customer service.
- Estimation of a marketing budget.
- Development of marketing plan evaluation methods.

To be most effective in ever-changing markets, growers should develop a thorough written marketing plan and adjust that plan over time.

Effective marketing begins with learning as much as possible about the market and identifying and understanding target customers and their values. A business' target customers are those customers with:

1. A need or desire the business can fulfill,
2. A willingness to purchase the product, and
3. The ability to purchase the product.

Growers should try to identify characteristics of these specific target customers including demographics and any relevant tastes and preferences or shopping behaviors. It is also important to identify if there are enough target customers willing to purchase enough product to make the enterprise viable.

If or when a viable target market is identified, growers should learn about what those customers value related to the product. Specifically, try to identify what consumers desire related to the four customer Cs:

1. Customer benefit — What customers want from the product.
2. Customer cost — What customers are willing to pay for the product.
3. Convenience — Where they are likely to purchase products and other needs.
4. Communication — How customers learn about products and make purchase decisions.

Growers should develop marketing strategies:

1. Specifically for their target customers and the values held by those customers,
2. With consideration for their business' mission and goals.

Sometimes called the marketing mix, marketing strategies include plans for six Ps of marketing — product, positioning, price, place, promotion and people.



Also, as part of a thorough marketing plan, growers should develop a marketing budget, marketing evaluation methods and a marketing plan checklist with a timeline of marketing activities and person responsible for completing each activity identified. Once a plan is developed, the work is just beginning. Producers must implement the plan, evaluate its effectiveness and adjust the plan as needed. Growers will also need to continually analyze the market as customers and their needs and values change over time. Target audiences may come and go, and marketing strategies may need revision as customer values evolve.

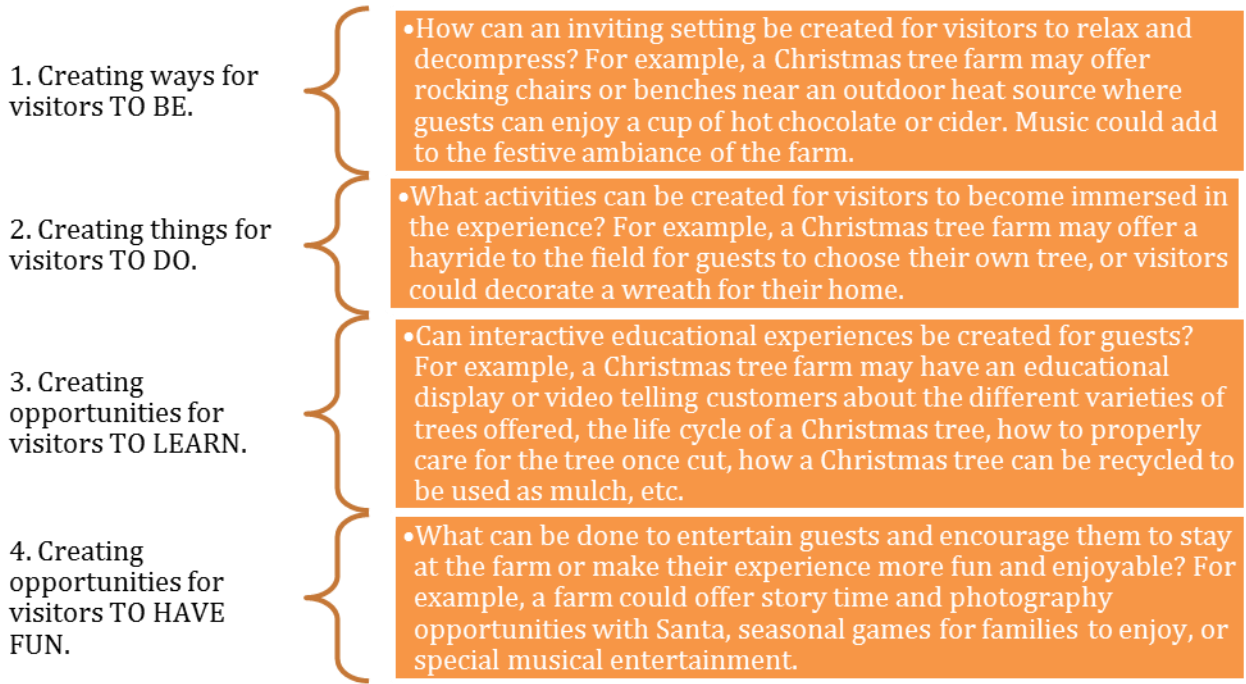
## Christmas Tree Farm Marketing Strategies

This section contains some specific considerations for Christmas tree growers for the six Ps of marketing — product, positioning, price, place, promotion and people.

### Product

**Product**, in the case of a Christmas tree grower, would of course include Christmas trees. Growers would need to choose varieties and sizes of trees desired by their target customers. Product could extend well beyond trees, however, to complementary products such as wreaths, garland, tree stands, decorations, etc. Product also could include any special services or features offered such as flocking, shaking, wrapping, loading/tying-down, delivery, or pickup and disposal after the holidays. The application of Christmas tree colorant to enhance needle color is another method of improving the product. Varieties like white and Virginia pine are more likely to be lighter in color and need colorant.

Beyond physical goods to purchase, customers purchasing real trees are often seeking an experience. An experience can add value by helping customers connect more personally with the business and form lasting memories. Christmas tree farms can help create positive customer experiences by:



Learn more in UT Extension publication W 361, “Creating the Customer Experience: Tips for Agritourism Entrepreneurs” ([extension.tennessee.edu/publications/Documents/W361.pdf](http://extension.tennessee.edu/publications/Documents/W361.pdf)).

## Positioning

**Positioning** refers to the message or image to be portrayed to potential customers in marketing efforts. Growers should consider what image would be most attractive to their target audience and authentic to their enterprise. Link the positioning to the benefit customers are seeking from the product or service offered. All aspects of the operation customers come in contact with should be consistent with and support this image. For example, if a Christmas tree farm positioned itself as an authentic, family-friendly farm, then everything from the promotional materials to the visual aspects of the farm to the service to the products offered should be consistent with this image.

## Price

**Price** relates to the price of each product or service charged to customers but may include payment types accepted. Growers should consider several factors before setting a price including the costs of production and marketing, competition, customer willingness to pay, and business goals. Learn more about pricing considerations and strategies in UT Extension publications PB 1803, “A General Guide to Pricing for Direct Farm Marketers and Value-Added Agricultural Entrepreneurs” ([extension.tennessee.edu/publications/Documents/PB1803.pdf](http://extension.tennessee.edu/publications/Documents/PB1803.pdf)). For cost information see Chapter 10 — Economics of Production. A common error is for Christmas tree growers compete with big retail stores on price. Along with providing a fresh, high-quality, locally grown tree, Christmas tree farms provide a family-oriented experience which has value well above the tree alone. Christmas tree growers should price their products based on costs, current prices at other tree farms and the species sold.

## Place

**Place** refers to the market channel and the location where products are sold. A Christmas tree farm may wholesale trees to others for resale and/or directly market products to consumers through retail sales, either on the farm or from another location. Retail sales may include pre-cut trees, ball and burlap trees for future planting, or choose-and-cut trees where customers pick out a tree and either cut it themselves or have it cut for them by a farm employee. For retail operations, place may also include the amenities offered to customers and customer and employee safety.

Growers generally can obtain higher product prices through retail channels; however, marketing costs are also higher as the grower may incur additional costs for labor, promotion, facilities, insurance, etc. Growers may also assume more risk of having to market products in smaller transactions, weather impacting sales on key weekends of the season, and inviting customers to the farm. Learn more about different marketing channel options, advantages and disadvantages in UT Extension publication PB 1796 “Choosing Direct Marketing Channels for Agricultural Products” ([extension.tennessee.edu/publications/Documents/PB1796.pdf](http://extension.tennessee.edu/publications/Documents/PB1796.pdf)).

## Promotion

**Promotional** strategies help growers to attract new customers, maintain relationships with existing customers and entice customers to purchase products. Promotional strategies often include advertising, direct communications with customers, publicity, public relations, merchandising, word of mouth and special offers. Choose promotional strategies based on where the target audience will be seeking information.

The Christmas Tree Promotion Board develops promotional materials for national campaigns. Materials for printing and digital media are made available for producers. Producers may access the materials from the website ([christmastreepromotionboard.org](http://christmastreepromotionboard.org)) and use them to help promote their own farm and the industry as a whole.

Creating partnerships with other farms, businesses or organizations important to the grower’s target audience may also be beneficial. For example, growers should consider joining organizations such as the Tennessee Christmas Tree Growers Association, local chamber of commerce or tourism organization.

Some Christmas tree farms offer field days for local schools and provide educational programs about growing trees. The field days are excellent opportunities to distribute brochures or coupons to generate customers. Be sure the farm has the facilities to handle such events. Contact the local newspaper about a picture and/or article prior to the sales season. If the newspaper is short-staffed write an article and provide a photo of the farm. Develop a brochure and provide copies to the chamber of commerce, visitor’s bureau and local businesses.

Websites are almost a requirement in today’s business environment. In addition, growers should consider these low-cost methods to communicating with customers and potential customers:

- Social media outlets such as Facebook, Instagram, Twitter, Pinterest, YouTube, Yelp and/or TripAdvisor.
- Email or e-newsletter to subscribers.



- Free listings in local food and farm directories and publications such as Pick Tennessee Products, LocalHarvest, The Local Table and the Appalachian Sustainable Agriculture Project (ASAP) Local Food Guide.

Growers should link websites and social media sites to any partner websites and social media. This includes the programs and publications offering free listings.

Signage is an important marketing tool for Christmas tree growers for promotional and other purposes. Learn how signs can benefit a farm and techniques for creating effective signage in UT Extension publication SP 766, “Creating Signage that Sells: Guidance for Specialty Crop Growers Direct Marketing to Consumers” ([extension.tennessee.edu/publications/Documents/SP766.pdf](http://extension.tennessee.edu/publications/Documents/SP766.pdf)).

Growers may also learn more about promotion in these Extension publications from the Center for Profitable Agriculture:

- UT Extension publication PB 1824, “Buying Advertising: Guidance to Specialty Crop Growers Direct Marketing to Consumers” ([extension.tennessee.edu/publications/Documents/PB1824.pdf](http://extension.tennessee.edu/publications/Documents/PB1824.pdf)).
- UT Extension publication PB 1823, “An Introduction to Marketing Opportunities on the Web for Specialty Crop Growers” ([extension.tennessee.edu/publications/Documents/PB1823.pdf](http://extension.tennessee.edu/publications/Documents/PB1823.pdf))
- CPA Info 237 Six Point Advertising Strategy Worksheet ([ag.tennessee.edu/cpa/Information%20Sheets/CPA%20237.pdf](http://ag.tennessee.edu/cpa/Information%20Sheets/CPA%20237.pdf))
- UT Extension publication D 13, “How to Handle Complaints and Poor Reviews on Social Media: Direct Marketing Tips for Specialty Crop Growers” ([extension.tennessee.edu/publications/Documents/D13.pdf](http://extension.tennessee.edu/publications/Documents/D13.pdf))
- UT Extension publication PB 1794, “Making the Most of the Market: Merchandising Considerations for Direct Farm Marketers” ([extension.tennessee.edu/publications/Documents/PB1794.pdf](http://extension.tennessee.edu/publications/Documents/PB1794.pdf))

## People

The marketing strategy, **people**, considers the service needs, desires and expectations of customers, including internal customers — employees or volunteers.

Customer retention is vital to the success of the venture. Customers stop supporting businesses for many reasons; however, the largest share of customers quit because of a poor customer service experience. Survey results indicate 89 percent of customers began doing business with a competitor after experiencing poor customer service, and 86 percent of customers would pay more for a better service experience (survey link is listed under Additional Resources). Like many businesses, however, growers may not know why a customer leaves their business, as, in general, an estimated 96 percent of unsatisfied customers will not complain or provide a reason — they just do not come back. Growers can work to keep customers happy by requesting and responding to customer feedback, clearly communicating, and handling problems effectively.

In order to keep customers satisfied, knowledge of their likes and dislikes about products and services is important. Producers may solicit feedback from customers in a variety of ways. Listening to and checking in with customers when they are finalizing their purchase may be beneficial. Growers also may issue invitations on websites and in electronic communications for customers to email questions, suggestions or comments. An end-of-season customer survey could provide more detailed information to help plan for the future. Growers can show care and concern for customers when they invite feedback and act to improve products and services based on customer input.

An ounce of prevention really is worth a pound of cure. Clear communication can solve many problems before they start and help customers form realistic perceptions and expectations. An electronic newsletter or social media postings can help keep customers up to date on what is happening on the farm and inform them of any news that may impact what products and services will be available.

These steps may help effectively handle customer problems when they do occur:

1. Listen and observe carefully. Try to identify the cause of the problem and what the customer really needs or wants.
2. Verify you are understanding the problem correctly. For example, repeat a complaint back in your own terms to confirm you heard or are understanding the problem accurately.
3. Apologize that the customer is upset. (This is not an admission you did anything wrong — unless you did — but to recognize that the customer is distressed.)
4. Acknowledge the customer's feelings, for example, if they are angry, frustrated or disappointed.
5. Explain what action you will take to correct the problem.
6. Thank the customer for bringing the problem to your attention.
7. Take action to correct the problem.
8. Follow up with the customer to make sure the problem was solved to their satisfaction.

## Additional Resources

The National Christmas Tree Association ([realchristmastrees.org](http://realchristmastrees.org)) polls consumers about Christmas tree trends annually. Results are reported on their website and may be helpful in understanding the Christmas tree market situation.

The Tennessee Christmas Tree Growers Association ([tennesseechristmastree.org](http://tennesseechristmastree.org)) conducts an annual meeting and field days each year to promote growing of Christmas trees and to assist new growers in learning the business. The TCTGA website is an excellent source for locating nearby growers and for links to a variety of suppliers for seedlings and equipment.

Additional resources are available on several of the marketing topics discussed in this chapter from the Center for Profitable Agriculture at [ag.tennessee.edu/cpa](http://ag.tennessee.edu/cpa). Publications with the most relevance include:

- UT Extension publication PB 1699, “Marketing for the Value-Added Agricultural Enterprise” ([extension.tennessee.edu/publications/Documents/PB1699.pdf](http://extension.tennessee.edu/publications/Documents/PB1699.pdf)).
- CPA Info Sheet 236, “Seeds for Successful Marketing: Take a Market Driven Approach” ([ag.tennessee.edu/cpa/Information%20Sheets/CPA%20236.pdf](http://ag.tennessee.edu/cpa/Information%20Sheets/CPA%20236.pdf))
- UT Extension publication PB 1806, “Sales Tax in Tennessee on the Purchase and Sale of Farm Products” ([extension.tennessee.edu/publications/Documents/PB1806.pdf](http://extension.tennessee.edu/publications/Documents/PB1806.pdf))
- UT Extension publication PB 1787, “Liability and Agritourism: Implications of Tennessee's 2009 Legislation” ([extension.tennessee.edu/publications/Documents/PB1787.pdf](http://extension.tennessee.edu/publications/Documents/PB1787.pdf))
- *2011 Customer Experience Impact Report*. Oracle. ([www.oracle.com/us/products/applications/cust-exp-impact-report-epss-1560493.pdf](http://www.oracle.com/us/products/applications/cust-exp-impact-report-epss-1560493.pdf))

## Summary

Marketing is a vital ingredient to enterprise success, including the potential success of a Christmas tree farm. It is critical for all producers who directly market products to consumers to understand fundamental marketing concepts and to develop thorough written marketing plans. Vital to effective marketing is identifying and understanding target customers and their values and then developing marketing strategies to reach them and meet their needs. Markets are dynamic and change over time. Growers must monitor the market and the effectiveness of their marketing strategies and continually adjust their marketing plan.

## Chapter 10: Equipment Needs

The typical Christmas tree farms will have most of the same standard equipment. This list should cover many of the items needed on a small (2 acre) to medium (7 acre) Christmas tree farm. Larger operations will likely need more mechanization to obtain labor efficiency, especially for planting and shearing of the trees. Most of these items are mentioned in the budget in the following chapter. A simple internet search for Christmas tree farm equipment or supplies should provide a current list of sources of most equipment and supplies needed. Also, a list of suppliers can be found on most Christmas tree farm associations websites.

The following is a list of common Christmas tree farm equipment.

### **Planting equipment:**

OST (old standard transplant) or dibble planting bar.

Manual post-hole digger.

Motorized auger — post-hole digger with 4 inch or 6 inch auger.

Bucket(s), gloves (leather and rubber), binder twine.

Backpack sprayer.

15- to 25-gallon 12-volt sprayer.

Lawn mower or small tractor with mower/rotary mower.

Single-shank subsoiler. (See planting tips for purpose.)

Hip tree planting bag.

### **Maintenance equipment:**

String trimmer.

Hand pruning shears.

Shearing knife.

Leg protection — Chaps or baseball catcher's leg guards.

Gloves - good quality leather or with sticky grip surface.

Motorized pruning/shearing tool — Beneke or SAJE.

Mower or tractor with mower (shielding may be needed to protect limbs).

Ear protection (if needed).

### **Sales equipment:**

Shaker — Electric, motorized or PTO driven.

Baler/Netter – Minimum 23 inch diameter, depending on farm size; two balers may be needed.

Bow Saws – Five to ten minimum.

Twine/rope to secure trees to vehicles.

Bungees or tie-downs to secure car trunks.

### **Other equipment/sales items:**

Wreath table and wreath rings for making wreaths.

Garland maker.

Tree stands.

Tree drill (if selling the center spike-type stands).

Tree removal bags.

Tree preservative.

Tree waterer.

Other decorations/gifts: Coloring books, candy canes, warm apple cider, etc.

## Chapter 11: Economics of Production

Any Christmas tree farm should begin with a solid business plan with projections of the possible income and expenses associated with the enterprise. The following Christmas tree budget addresses production of white pine or Virginia pine Christmas trees. The budget includes labor expenses, which may be provided by the grower/owner or a portion of it may be hired labor. Also included is the cost of most of the commonly used equipment for a small- to medium-sized farm. A range of the total out-of-pocket cost is found at the end to give an estimate of how much total investment may be involved by the seventh year of production.

Verify updated/current costs to ensure the accuracy of any farm plan developed. For assistance in developing a farm/business plan, contact your county Extension office and ask to be referred to an area farm management specialist.

The budget is based on planting **ONE-HALF** acre or about 500 seedlings per year. This would equate to around 3,000 to 3,500 (3.5 to 4 acres) trees growing at all sizes by the seventh year of planting. Doubling of the costs (except equipment) and returns should provide an estimate of 1 acre (1,000 seedlings) planted annually.

For additional information about budget calculations see the notes at the end of the budget. The budget does not provide for land improvements such as gravel for driveways or parking areas, sales and storage building(s), permanent restrooms or other similar capital improvements.

## Estimated Budgets for Christmas Trees: White Pine and Virginia Pine

Rev. 06/01/2017

Disclaimer: Costs and returns are an estimated for Tennessee; actual returns can vary widely with weather, disease, insects and management factoring heavily in final returns. Chemicals mentioned are not promotions of these products and may be substituted with other recommended chemicals.

Figures estimated for **ONE-HALF ACRE** of either variety      White Pine      Virginia Pine

### YEAR 1:

Site Prep — Mow 0.25 hr. at \$30	7.50	7.50
Subsoil — 0.5 hr. at \$35	17.50	17.50
Treat 2-foot strip w/Glyphosate (Roundup)	6.00	6.00
Application — hand or mechanical sprayer	7.50	7.50
Fertilizer (100 lbs. 10-10-10) plus cost of soil test	40.00	40.00
Seedlings — 500 (6 X 6 with driveways or 6 X 7)	150.00	75.00
Planting (labor)	62.50	62.50

Estimated cost of other varieties of seedlings:

Scotch pine, blue spruce, Norway spruce add \$300/0.5 ac.

Leyland cypress, Blue Ice, Carolina Sapphire add \$300 to \$450/0.5 ac.

Canaan fir add \$450/0.5 ac.

Grass and Weed Control:

Mowing (2.5 hrs. at \$14)	35.00	35.00
Glyphosate (2 treatments)	3.00	3.00
Application (1.0 hour labor)	10.00	10.00

Insect Control:

Various insecticides	6.00	6.00
Application (labor)	6.00	6.00

Corrective clipping 0.5 hr. (labor)	<u>5.00</u>	<u>5.00</u>
Subtotal	356.00	281.00
Interest 4%	14.24	11.24

Equipment/other expenses: (actual needs may vary)

OST or dibble planting bar \$45/20 yr.	2.25	2.25
Buckets, gloves, binder twine	20.00	20.00
Backpack sprayer \$90/10 yr.	9.00	9.00
Weed eater \$300/10 yr. plus fuel and maintenance	35.00	35.00
Equipment Total	<u>66.25</u>	<u>62.25</u>
Total Year 1	436.49	358.49

*Optional equipment: 25 gallon sprayer \$200, one-man gas auger for planting \$428*



<b>YEAR 2:</b>	White Pine	Virginia Pine
Seedling Replacement (20% white, 10% Virginia)	30.00	11.50
Replanting (labor)	15.00	7.50
Fertilizer (75 lb. or 2.5 oz./tree) (use soil test)	15.00	15.00
Annual Weed Control:		
Mowing	35.00	35.00
Pre-emergent herbicide plus glyphosate or		
Glyphosate (3 treatments)	4.50	4.50
Application (labor)	7.50	7.50
Annual Insect Control:		
Various insecticides	6.00	6.00
Application (labor)	6.00	6.00
Shearing 1 hr./3 hr. (labor)	<u>10.00</u>	<u>30.00</u>
Subtotal	129.00	123.00
Interest	5.16	4.92
Equipment/other expenses:		
Hand pruner with holder \$75/10 yr.	7.50	7.50
Shearing knife, chaps and sharpener \$100/15 yr.	7.00	7.00
Equipment Total:	<u>14.50</u>	<u>14.50</u>
Total Year 2	148.66	142.42

*Optional equipment: Motorized rotary pruner \$460*

<b>YEAR 3:</b>	White Pine	Virginia Pine
Fertilizer	15.00	15.00
Annual Grass and Weed Control:		
Mowing	25.00	25.00
Pre-emergent herbicide plus glyphosate or Glyphosate (3 treatments)	4.50	4.50
Application (labor)	7.50	7.50
Annual Insect Control:		
Various insecticides	6.00	6.00
Application (labor)	6.00	6.00
Shearing 3 hr./5 hr. (labor)	<u>30.00</u>	<u>50.00</u>
Subtotal	94.00	114.00
Interest	<u>3.76</u>	<u>4.56</u>
Total Year 3	97.76	118.56

<b>YEAR 4:</b>	White Pine	Virginia Pine
Fertilizer	25.00	25.00
Annual Grass and Weed Control:		
Mowing	25.00	25.00
Pre-emergent herbicide plus glyphosate or Glyphosate (3 treatments)	4.50	4.50
Application (labor)	7.50	7.50
Annual Insect Control:		
Various insecticides	6.00	6.00
Application (labor)	6.00	6.00
Shearing 12.5 hrs./22.5 hrs. (labor)	<u>125.00</u>	<u>225.00</u>
Subtotal	199.00	299.00
Interest	<u>7.96</u>	<u>11.96</u>
Total Year 4	206.96	310.96

<b>YEAR 5:</b>	White Pine	Virginia Pine
Fertilizer	25.00	25.00
Annual Weed Control:		
Mowing	25.00	25.00
Pre-emergent herbicide plus glyphosate or Glyphosate (3 treatments)	4.50	4.50
Application (labor)	7.50	7.50
Annual Insect Control:		
Various insecticides	6.00	6.00
Application (labor)	6.00	6.00
Shearing 15 hrs./25 hrs. (labor)	<u>150.00</u>	<u>250.00</u>
Subtotal	224.00	324.00
Interest	8.96	12.96
 Equipment / other expenses:		
Shaker \$1,550.00/15 yr.	110.00	110.00
Baler \$290/15 yr.	20.00	20.00
Saws (6) \$13 each/10 yr. plus replacement blade	14.00	14.00
Signage (varies) \$250/15 yr.	17.00	17.00
Equipment Total	<u>227.25</u>	<u>227.25</u>
Total Production expenses	393.96	497.96
 Sales Expenses: (Virginia Pine)		
Colorant		7.50
Application (labor)		9.00
Cutting (labor)		100.00
Baling — cost of netting		65.00
Advertising		<u>100.00</u>
Total Sales Expenses		281.50
 Sales Income:		
Virginia Pine: 108 trees at \$30 (1/3 of trees)		3,240.00

*Optional equipment/other: Sales building/shed \$2000 and up, porta-potty rental, display racks for precut trees, wreath maker and wreath rings, tree disposal bags, tree preservative, coloring books, etc.*

<b>YEAR 6:</b>	White Pine	Virginia Pine
Fertilizer	25.00	15.00
Annual Weed Control:		
Mowing	25.00	25.00
Pre-emergent herbicide plus glyphosate or Glyphosate (3 treatments)	4.50	4.50
Application (labor)	7.50	7.50
Annual Insect Control:		
Various insecticides	6.00	6.00
Application (labor)	6.00	6.00
Shearing 15 hrs./22.5 hrs. (labor)	<u>150.00</u>	<u>225.00</u>
Subtotal	224.00	289.00
Interest	<u>8.96</u>	<u>11.56</u>
Total	232.96	300.56
 Sales Expenses:		
Colorant	7.50	15.00
Application (labor)	9.00	18.00
Cutting (labor)	100.00	200.00
Baling — cost of netting	65.00	130.00
Advertising	<u>100.00</u>	<u>100.00</u>
Total Expenses:	281.50	463.00
 Sales Income:		
White Pine: 108 trees at \$30	3,240.00	
Virginia Pine: 217 trees at \$30		6,510.00

<b>Year 7:</b>	White Pine	Virginia Pine
Fertilizer	15.00	
Annual Weed Control:		
Mowing	25.00	
Pre-emergent herbicide plus glyphosate or Glyphosate (3 treatments)	4.50	
Application (labor)	7.50	
Annual Insect Control:		
Various insecticides	6.00	
Application (labor)	6.00	
Shearing 17 hrs. (labor)	<u>100.00</u>	
Subtotal	164.00	
Interest	<u>6.56</u>	
Total	170.56	
Sales Expenses:		
Colorant	15.00	
Application (labor)	18.00	
Cutting (labor)	200.00	
Baling — cost of netting	130.00	
Advertising	<u>100.00</u>	
Total Expenses: Year 7	463.00	
Sales Income:		
White Pine: 217 trees at \$30	6,510.00	

	White Pine	Virginia Pine
<b>Summary:</b>	Expenses	Income
Year 1 Expenses	436.49	358.49
Year 2 Expenses	148.66	142.42
Year 3 Expenses	97.76	118.56
Year 4 Expenses	206.96	310.96
Year 5 Expenses	393.96	779.46
Estimated Income		3,240.00
Year 6 Expenses	514.46	763.56
Estimated Income	3,240.00	6,510.00
Year 7 Expenses	633.56	
Estimated Income	6,510.00	
Totals	2,431.85 9,750.00	2,473.45 9,750.00
Net Income <b>(one-half acre)</b>	7,318.15	7,276.55
Net Income average per year WP-7 yr., VP-6 yr.	1,045.45	1,212.76
Estimated labor expense included in budget	1,079.00	1,273.00
Total estimated out-of-pocket costs (includes listed equipment)	4,998.55	5,040.15

Notes and other information:

1. Seedling cost based on purchase from Tennessee Division of Forestry nursery. White and Virginia pine are the only Christmas tree species available from the state nursery. Those and other species may be obtained from privately owned Christmas tree seedling nurseries.
2. Spacing of trees is estimated at 6 feet by 6 feet allowing for walkways or driveways or 6 feet by 7 feet to obtain the same number per acre. Planting of one-half acre each year will create a farm of 3 to 4 acres in production when sales begin.
3. Tree selling price is an estimated low retail price. Actual selling price should be based on the current market.
4. Equipment expenses listed are shown divided by estimated working life of the item. Some possible additional equipment expenses are noted below each section with estimated cost.
5. Estimated sales only account for 65 percent of seedlings planted. The actual percentage sold will vary. One-third of the trees are sold in the first year of sales and the remaining two-thirds the second year of sales.
6. Tree sales could and likely will extend into the eighth and ninth year or longer.
7. Most expenses for Scotch pine and Norway spruce would be similar to white pine. Norway spruce would reach maturity like white pine. Scotch pine could take one to two years longer. Leyland cypress and Arizona cypress would mature in 5 to 6 years similar to Virginia pine. Canaan fir would mature in 8 to 10 years. These maturity timeframes are estimates and will vary with climate, soil nutrition and management.
8. If planting continues by adding one-half acre each year, the variable expenses for each one-half acre will need to be added to calculate total estimated expenses for each additional year.

Budget revised by: Alan B. Galloway, Area Specialist, Farm Management, UT Extension



## Chapter 12: Records, Taxes and Insurance

Accurate records must be maintained to enable preparation of tax returns and to measure the profitability and efficiency of the operation. Records needed include production and financial information. For financial records, Quicken® software or a similar financial record keeping program is an inexpensive option meeting the needs of most producers. For a large farm where wholesale trees are marketed and significant labor expense is involved, a more complete accounting program like QuickBooks® might be a better fit.

Production records such as the source of seedlings, variety, quantity and date of planting should be recorded either in a simple notebook or computer software so these records can be easily reviewed when needed. A diagram or drawing of the rows planted with varieties noted will be useful as well. As the trees grow, notes can be added related to fertilizer and chemicals applied to the trees along with notes about diseases, insects, growth habits, etc. This information can be helpful in the future for comparing the growth of seedlings from various sources and whether diseases were more common in certain blocks of trees.

All pre-cut trees purchased for resale are subject to inspection by the Tennessee Department of Agriculture to ensure no tree diseases or insects are brought into the state. All such purchases should come with an invoice and/or other documentation showing the origin of the trees and if any such inspection has already occurred. Nursery inspectors often arrive during the selling season to ensure the safety of Tennessee trees by checking these records.

If live trees are sold, either in a container or balled and burlap, the farm is subject to the same inspection rules as any nursery and would be required to pay an annual inspection fee. Small tree farms will need to determine if sufficient income will be made from live tree sales to justify the cost of the inspection.

### Income Tax

Expenses for seedlings, chemicals, fertilizer, equipment, etc. must be maintained for tax calculations and to enable calculation of an accurate cost of trees sold. Christmas tree farms fall into a unique category for federal income taxes. Recommended reading is IRS publication 225 (Farmers Tax Guide) and information at [www.timbertax.org](http://www.timbertax.org). For tax purposes, cut Christmas trees can be handled much the same as sales of timber. Many of the costs can be capitalized into the cost of the tree, which in turn reduces the taxable income when sold. Depletion allowance is also permitted. A portion of the income can be claimed as capital gains income, which is taxed at a lower rate than ordinary income. Having an understanding of these concepts in the beginning will enable a grower to keep sufficient records to take advantage of these potential tax savings.

Those selling live Christmas trees, either container or balled and burlap (B&B), will need to maintain records of those sales separately. Sales of additional items like wreaths, garland, tree stands, decorations, etc. will need to be recorded carefully as well. Seek the counsel of a qualified tax preparation expert who understands farming and timber sales to help guide you through the process.

## Sales Tax

### Tax on Sales

The Tennessee sales tax law is fairly generous to farming and Christmas tree farms. Generally, most sales from products grown on the farm or made from products grown on the farm are not subject to sales tax. Current sales tax law allows for sales of pre-cut trees purchased for resale to be nontaxable if the gross sales from those trees are less than the sales from trees grown on the farm. If sales from the purchased trees become more than 50 percent of total sales then sales tax would be collected on the sales of the purchased trees.

Wreaths made from trees grown on the farm would be handled the same way and be nontaxable. If other items such as decorations, tree stands, etc. are sold, in most cases sales tax should be collected. Contact the Tennessee Department of Revenue and/or local Extension office for updated information on collecting sales tax.

### Exemption From Paying Sales Tax

The Tennessee Department of Revenue can exempt farmers (including Christmas tree growers) from paying sales tax on purchases of many supplies (seed, seedlings, fertilizer, chemicals, etc.) and equipment (tractors, rotary mowers, tree shakers, balers, etc.) used in the production of their crops. Producers can apply for the Agricultural Sales and Use Tax Certificate of Exemption on the Tennessee Department of Revenue directly on its website. Download the application form from the Department of Revenue website or obtain a copy from a local Extension office.

## Insurance and Risk Management

Christmas tree growers, especially choose-and-cut operations, should review and verify insurance coverage to manage and reduce potential risks should an accident or other event occur.

### Property Insurance

With additional tools, equipment and sales buildings/sheds being added to the farm inventory, Christmas tree farm operators should review their insurance policy with their agent to verify coverage.

### Liability Insurance and Laws

Since Christmas tree farms invite customers to the farm, liability coverage in case of accidents is strongly recommended. Some insurance companies write policies specifically for Christmas tree farms and sales lots while others write coverage for all types of agritourism enterprises. The size of operation along with whether other activities (like hayrides) are involved in the process of selling trees factor into coverage needs and the cost of the policy. An umbrella liability policy may be desired to provide additional protection. Review any current farm policy to verify it will cover any claims once the farm begins selling trees. Tennessee has an agritourism liability law which provides some protection. It has specific requirements of the farm related to posting of signage about the law. For more information see UT Extension publication PB1718, "Liability and Agritourism: Implications of Tennessee's 2009 Legislation" ([extension.tennessee.edu/publications/documents/PB1781.pdf](http://extension.tennessee.edu/publications/documents/PB1781.pdf)).

## Crop Insurance

Christmas trees are not currently insurable through traditional crop insurance policies. Coverage may be obtained through the Noninsured Crop Disaster Program (NAP). NAP coverage is limited. The farm must have greater than a 50 percent loss and the insurance will pay 50 percent of the value of the crop. Contact your local Farm Service Agency (FSA) office for additional information about the NAP insurance program. Another possible insurance is Adjusted Gross Revenue-Lite. AGR-Lite is a whole-farm revenue protection plan of insurance that protects against low revenue due to unavoidable natural disasters and market fluctuations. Most farm-raised crops, animals and animal products are eligible. AGR-Lite can stand alone or be used in conjunction with most other Federal crop insurance plans. To use AGR-Lite the farm must have five years of Internal Revenue Service (IRS) Schedule F forms. A local agent who sells crop insurance could provide more information about AGR-Lite.

## Chapter 13: Grower Tips

The chapter is a collection of short, simple suggestions from the experiences and wisdom of Tennessee Christmas tree growers.

### Planting and Growing Tips:

1. To keep rows straight, use binder twine or flagging to lay out the rows to be planted. The twine is inexpensive and can be placed in the grass. Check width between rows. Spray a 2-foot-wide strip using glyphosate over the top of the twine a couple weeks before planting. Remove twine when dry and save for next year.
2. Especially if planting in clay soils or soil where a hard pan exists use a tractor and a single shank subsoiler to rip straight down the middle of the sprayed strip. This makes planting with an OST/dibble bar very easy. Prior to planting, to reduce the hump caused by the subsoiler, drive along the strip with a large mower or small tractor to pack it down.
3. Seedling sources — be careful when ordering seedling from northern sources. Check that a variety like white pine was grown from a southern seed source. White pine seedlings grown from a northern seed source may not provide good growth in Tennessee's climate.
4. Seedlings for Scotch pine, blue spruce, Norway spruce, and other species seldom list a southern or northern seed source. Check with other growers in the area for varieties that grow well.
5. Planting at least a 3-0 size seedling will improve growth and minimize death loss. The 3 is the number of years in the seedling bed and the zero is the number of years in the transplant bed. Larger and older seedlings (3-1, 4-0, etc.) may further improve growth; however, the higher cost may not justify the slight improvement. Larger seedlings can be more difficult to plant.
6. When mowing rows, keep mower tires from rubbing lower limbs. Damage can occur making trees less attractive. Some zero-turn mowers are worse than standard lawn mowers because the rear wheels are wider set and more likely to rub limbs. Guards or shields might be added to protect limbs and needles.
7. Be very cautious using a string trimmer around trees. One slight touch to a small seedling and it may die. The cost of the seedling along with the labor used to plant it could be lost. If a string trimmer must be used, use the shield and back up to the tree to keep the string away from the trunk.

## Shearing Tips:

1. Always use clean, sharp tools for any type of pruning or shearing. Spray lubricant and fine steel wool are excellent for removing pine sap/tar from the sides of shearing knife blades and hand pruners. Clean and sharpen immediately after stopping for the day. Cleaning (and sharpening) during shearing will reduce drag on the blade and improve cuts.
2. A small spray bottle of rubbing alcohol and an old pocket knife are handy for cleaning sap off a shearing knife. The alcohol acts as a disinfectant, too.
3. A sharp tool provides cleaner cuts to enhance growth for future years.
4. If shearing any diseased trees, wait to shear them at the end of the day and/or clean the knife/pruner with a 10 percent bleach solution before shearing other trees.
5. During the shearing process, carefully observe for insects that could damage the trees or sting people.
6. Do not continue shearing when tired; both shearing mistakes and accidents can occur.
7. When shearing with a knife, always swing away from the body. Never “cross-back” to shear a previously missed branch. Simply circle the tree again.
8. Use sunscreen and wear a wide-brimmed hat.
9. Shearing is the most physical, time-consuming practice of all activities. Consider hiring it out and observing before doing it yourself.

## Marketing Tips:

1. Plan in advance for location of sales building, parking and loading area.
2. Line up equipment (shaker and baler) for efficiency of labor and to help direct customers to other items for sale (stands, wreaths, etc.).
3. If selling precut trees, plan how they will be displayed and keep them close to shaker/baler/load out area. If possible, develop a system to keep precut trees watered prior to sale.
4. Store precut trees in a shaded area or north side of a building. Treat them as a perishable product like flowers. Do not store under a plastic tarp as they build up heat. Protect trees from the wind.
5. A great source of inexpensive buckets may be a local donut shop. A bucket cut in half makes a 2-gallon tree waterer. Check for other sources of inexpensive buckets in your area.
6. Good clear signage explaining prices, types of trees available, directions to trees for sale and other activities reduces the number of questions needing answered on sales days.
7. Have clearly understood signs to the parking area that are readable while driving.
8. If the farm is a “choose and cut” farm, have a set policy on whether a customer can dig their own tree. If allowed, price accordingly as the hole will need to be filled promptly to prevent an accident.
9. Have a presence on the internet. Facebook, Twitter or your own website are good outlets. Most customers will search the web looking for nearby tree farms. Do not miss out on sales by not having an internet presence.
10. If tree colorant is desired or needed, apply in early October, before the first freeze.
11. Be sure to obtain all required licenses from the city, county and/or state.
12. Ask yourself, “How will customers feel when they arrive? While they are on the farm? When they leave?” Focus on a good customer experience as much as the quality of the tree.
13. Track and log customers so you can market to them each year. A giveaway may be used to entice customers to register and provide their email and/or mailing address.

## References

- Bennett, B. 1995. Leyland Cypress. Georgia Christmas Tree Association, Inc. Tree Talk, Vol. 9 No. 1. 19-25.
- Benyus, J. 1983. Christ Tree Pest Manual. U.S. Forest Service. North Central Forest Experiment Station. St. Paul, Mn.
- Burns, R. and B. Honkala. 1990. Silvics of North America: Vol. 1, Conifers. U.S. Forest Service. Agriculture Handbook No. 654.
- Fowells, H. 1965. Silvics of Forest Trees of the United States. U.S. Forest Service. Agriculture Handbook No. 271.
- Gwinner, G. 1988. Christmas Trees from Seed to Sale. Tree Publishers, Inc. Lecompton, Ks.
- Helms, J. 1998. The Dictionary of Forestry. The Society of American Foresters. Bethesda, Md.
- Hogan, M., Marrison, D., Boggs, J., Titchell, M., Chatfield, J., Mathers, H., Smith, K., Apsley, D. and Young, C. 2014. Ohio Christmas Tree Producers Manual. Ohio State University Extension bulletin 670.
- Mercker, D. 2002. Tree Crops for Marginal Farmland: Christmas Trees with a Financial Analysis. The University of Tennessee Institute of Agriculture Extension Service. Knoxville, Tn. (Revised).
- Nicholls, T. and R. Wray. 1989. Pocket Guide to Christmas Tree Diseases. U.S. Forest Service. North Central Forest Experiment Station. St. Paul, Mn.
- Stringer, J., W. Clatterbuck and J. Seifert. 2009. Site Preparation and Competition control Guidelines for Hardwood Tree Plantings. The University of Tennessee Institute of Agriculture Extension. Knoxville, Tn.
- Thor, E. 1985. Production of Christmas Trees in Tennessee. The University of Tennessee Institute of Agriculture. Knoxville, Tn.

### Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.







AG.TENNESSEE.EDU

PB 1854 R12-6210-185 3.0M 8/17 17-0204

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating.

UT Extension provides equal opportunities in programs and employment.