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POWELL RIVER PROJECT

Growing Christmas Trees on Reclaimed Surface-Mined Land

Authored by J. A. Burger, Professor Emeritus, Forestry and Soil Science, Virginia Tech; Kyle Peer, Superintendent, Reynolds Homestead Forest Resources Research and Extension Center, and C. E. Zipper, Extension Specialist, Crop and Soil Environmental Sciences, Virginia Tech
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Introduction

Christmas tree production can be an excellent use for reclaimed mined lands in Virginia. Most species do quite well on mine soils because they are more tolerant of infertile and droughty conditions than agricultural or horticultural crops, yet they do respond to active management. Christmas trees can be harvested within seven to 10 years, while timber crops take much longer to mature. For the person with time to invest, Christmas trees can be an ideal way to put small parcels of reclaimed mined lands to profitable use. Individual growers can conveniently maintain up to 5 acres of trees in their spare time.

Several publications about Christmas trees are available from Virginia Cooperative Extension (see References). These publications concern all aspects of Christmas tree production and marketing, and they should be obtained for more detailed information about weed and pest control, shearing, and other aspects of Christmas trees that apply to all Christmas tree growers. This publication provides only general information for owners and managers of reclaimed mined land. It covers specific considerations for the establishment and maintenance of Christmas tree species on reclaimed mine soils.

Selection of Planting Site

Soil

The key to the successful production of Christmas trees on reclaimed mined land is selecting a suitable site. Most mined land in the central Appalachian region is reclaimed with topsoil substitutes – blasted rock from one or more layers of the overburden removed in the process of surface mining for coal. Many mine soils contain more than 50 percent rock fragments, which usually will not hinder tree growth but which may limit the use of some machinery, such as mowers and mechanical tree planters. The mine soil must be deep and uncompacted so that a healthy root system can develop. Sites with standing water after a rain are probably too compacted or poorly drained for Christmas trees. Growers should look for sites that have brown, sandy soils and a pH of 5.0 to 6.0. Any dark gray or black mine soils should be carefully evaluated before planting, because they are often associated with a very high or very low pH.

Slightly rolling reclaimed landscapes with slopes ranging from 2 percent to 8 percent are good places to grow Christmas trees because they are flat enough for machine operations yet sloped enough for good surface drainage (see figure 1). Unfortunately, tree growth is often poor on relatively flat areas because the soil is often shallow or compacted from heavy equipment.

Beginning in 2005, some coal operators began using the Forestry Reclamation Approach (see *How to Restore Forests on Reclaimed Mined Lands,* Virginia Cooperative Extension publication 460-123), which includes selecting overburden materials for the surface that have good physical and chemical properties for trees, and placing these mine soil materials loose and 4 feet deep. Surface grading is minimized to keep from compacting the new mine soil. This Forestry Reclamation Approach will produce good sites for Christmas trees as well as for native hardwoods; however, these sites may require additional smoothing and rock removal for efficient Christmas tree operations. This final site preparation could be done with farm machinery to avoid compacting the mine soil.

Figure 1. This reclaimed mine site at Powell River Project Research and Education Center in Wise County has proved to be an excellent site for Christmas tree production because of a moderate slope that enables water to run off but does not hinder equipment operation, uncompacted soils, and favorable soil properties. The site has been producing several species of Christmas trees since the mid-1990s.

Mine sites prepared using traditional reclamation methods are smoother but are often too compacted for good tree growth. A good method to check the soil depth and compaction is to make holes in the ground with a "dibble" bar in a similar fashion to opening holes for planting trees. In the spring or fall, when the soil is moist, it should be easy to make holes that are about 1 foot deep. If holes can only be made a few inches deep because of underlying bedrock, or if it takes many attempts to open a single hole because the soil is compacted, then the site is not good for Christmas trees. It is always necessary to check the soil depth in several locations of a field. A single sample point may not be typical of the entire site. On pre-1977 benches, it is common for soils to be deeper at the outer edges than close to the highwalls.

Vegetation

On older sites, existing vegetation can provide clues to the suitability of a site for Christmas trees. Many mined sites in Virginia were planted with white pine at the time of reclamation. If white pines growing in an area considered for Christmas trees are not growing well, it is likely that the site is not suited for Christmas trees. Healthy 6-foot (or taller) white pines should have about 1.5 to 2 feet between the uppermost whorls of branches, and the foliage should look healthy. Trees with less than a foot between whorls of branches, or trees with sparse, yellow- or bronze-colored foliage, may indicate a site problem.

Areas devoid of vegetation often indicate a soil problem. Large areas or small, localized "hot spots" can be nearly devoid of vegetation because of toxicities associated with extreme acidity from high pyrite concentrations or high salt levels. Many areas have sparse, woody cover that may include small sourwood, black birch, and red maple seedlings and some moss-like vegetation. These areas usually have a low (but not toxic) pH that can be corrected by liming and, if not compacted, should be acceptable for Christmas trees.

Sites with healthy stands of *Sericea lespedeza* or tall fescue probably have good soil for Christmas trees. Much reclaimed mined land is covered with lespedeza and black locust. Both of these nitrogen-fixing species are good "soil builders" that can increase the organic matter content and the amount of nitrogen in mine soils. Sites that have been occupied by these species are generally good sites to raise Christmas trees.

However, both lespedeza and locust are aggressive plants that can cause problems for Christmas trees by overtopping young seedlings and competing for soil moisture and nutrients. Although growers can convert areas with lespedeza and woody species, it is imperative that proper site preparation techniques are used to remove or control these species before the trees are planted. This will require the use of mechanical equipment and herbicides to clear the land. Ideally, a Christmas tree grower would select sites during or after active mining, or prior to significant invasion of herbaceous and woody species that are difficult to remove or control.

Soil Sampling

A soil sample should be collected and analyzed to determine if the mine soil has suitable chemical properties. Local Virginia Cooperative Extension offices will provide cardboard sampling boxes and information sheets that need to be returned to the Extension office or sent directly to the Virginia Tech Soil Testing Laboratory (see References).

The area chosen for Christmas trees should be broken into soil sampling units. Areas with uniform soil color and vegetation type should be sampled separately from areas with obviously different soil or ground cover conditions.

From each sampling unit, use a shovel to collect one scoop of soil, about 6 to 10 inches deep, at 10 locations evenly distributed across the area. Remove all rocks from each sample. Mix all 10 samples in a bucket. After the soil is well-mixed, fill the cardboard sample box with a subsample from the bucket.

The soil test results will include soil pH and soil nutrient information. Soil pH is of particular importance. Sites with a pH of less than 4.0 or more than 6.5 should be avoided. Soils with a pH of less than 5.0 should be limed to raise the pH to between 5.5 and 6.5. Most mine soils will be deficient in several nutrients. These deficiencies can be corrected by fertilization (discussed later in this publication).

Species Selection

The most common Christmas tree species planted in Virginia are white pine, Scotch pine, Fraser fir, and Norway spruce (see *Species for Christmas Tree Planting in Virginia,* Virginia Cooperative Extension publication 420-082). Seedlings of most of these species can be purchased from the Virginia Department of Forestry. Other species such as Colorado blue spruce, Douglas-fir, and white fir are in high demand but are planted in Virginia to a lesser extent than the other species. These additional species can be grown on Virginia mine soils; however, seedlings are more expensive and must be purchased from private nurseries.

Of all species mentioned, Fraser fir requires the deepest, most fertile soils because it is the least drought-tolerant and most nutrient demanding. The greatest concern about Douglas-fir is its sensitivity to late spring frosts. Both Fraser fir and Douglas-fir should be planted on north-facing aspects where soil is cooler and trees remain dormant longer than trees on south-facing slopes. This will reduce the chance of freeze damage.

Another consideration pertains to the seasonal shearing requirements for the different species. Spruces and firs can be sheared almost any time of year; however, the pines must be sheared during a four- to six-week period during the summer. Growers who do not want to hire labor should consider planting a mixture of species in order to prolong the time available for shearing.

Site Preparation

Site preparation is necessary for tree establishment and to create conditions conducive to good tree growth and efficient management operations. Site preparation must begin at least a year before planting. The amount of site preparation needed depends upon the conditions of the site. The site must be cleared of trees, large movable rocks, and other obstacles before planting. Trees and shrubs should be killed with herbicides prior to cutting in order to reduce their potential for sprouting. Black locust in particular is a prolific sprouter. If not killed, a single tree can produce more than 50 sprouts after the tree is cut. These sprouts can grow as much as 10 feet in the first year and quickly turn a Christmas tree planting into a locust thicket.

If the site is covered with *Sericea lespedeza* or tall fescue, the entire area should be mowed in the summer the year prior to planting. When the regrowth reaches about 12 inches high, a 3-foot-wide band of herbicide should be sprayed in rows where trees will be planted. A better, but more expensive, alternative is to broadcast spray the entire field, broadcast fertilizer and lime based on a soil test, till the field with a heavy disc harrow, and sow the field with a less competitive ground cover consisting of cool season grasses and legumes, such as bluegrass, redtop, timothy, and ladino clover. If lespedeza and tall fescue ground covers are not killed before the trees are planted, they will block light by overtopping tree seedlings and compete with seedlings for soil water and nutrients. It is much easier and cheaper to kill this vegetation during the year prior to planting than it is after trees are planted.

If analysis of a soil sample indicates a need for liming, the lime should be applied a year before planting. The site should be disked to incorporate the lime and loosen the surface soil.

Tree Planting

As soon as seedlings are delivered by the Virginia Department of Forestry or private nurseries, they must be kept cool and moist, preferably in cold storage (40 degrees). Seedlings are very sensitive and may die if bundles are allowed to warm for more than a few hours. If roots are allowed to dry in storage or in the field before planting, new root growth will be retarded, and survival and growth will suffer. For best results, the roots should be dampened when seedlings are received. Rewrapping the seedling bundle and storing it in a cool place will keep the seedlings in a cool, moist, humid environment.

During planting, the seedlings should be carried in the field in a bucket of water or a wet planting bag. Seedlings should be removed from the bucket or bag one at a time as they are being planted. Roots should not be pruned, and the whole root system should be planted in the hole, even if it requires bending the roots. The roots should be placed in the planting hole so that the seedling is planted about 1 inch deeper than it was growing in the nursery. If the root system is too long for the hole, the hole should be dug deeper and wider. If the ground is too hard to make a hole large enough for the seedling, the site is probably not suitable for Christmas trees.

For best results, a fertilizer pellet should be used when planting seedlings. These pellets are available from many nurseries or forestry/nursery suppliers and cost about 20 cents each. Pellets about the size of a marshmallow (1 ounce) supply a slow-release source of nutrients to the seedling for two to three years. A pellet should be placed at the bottom of a hole located about 4 inches to 6 inches from the planting hole so that it is not in direct contact with the roots. The hole for the fertilizer pellet should be as deep as the planting hole. Fertilizer should never be placed in the planting hole or in contact with the roots or stem.

In early spring, after planting, a pre-emergence herbicide should be sprayed within the 3-foot-wide planting row to reduce the amount of vegetation that will grow around the seedling and compete for soil moisture during the summer (see figure 2). Several Virginia Cooperative Extension publications provide information about appropriate herbicides and application techniques (see References).

The first year is an especially critical time for tree establishment. On properly selected sites, trees will seldom die once they survive the first year. With good site selection, tree planting techniques, and weed control, growers should expect 80 percent to 90 percent survival. Trees that die should be replaced during the second year.

Figure 2. Spraying a herbicide in a 3-foot radius around growing Christmas trees can control vegetation, which prevents it from removing water and nutrients from the soil that could be otherwise utilized by the Christmas trees.

Maintenance of Christmas Tree Plantations

Virginia Cooperative Extension provides many publications covering the necessary management practices, such as weed control, insects, diseases, shearing (see figure 3), harvesting, and marketing of Christmas trees (see References).

The primary difference between maintaining Christmas trees on mine soils versus native soils is the need for frequent fertilization. Mine soils have inherently low levels of certain nutrient elements, and research and experience shows that Christmas trees benefit from an annual application of fertilizer. Although many mine soils that do not require annual fertilization probably exist, there is currently no proven technique to reliably identify those soils. Because fertilizer is relatively inexpensive, growers have more to lose by not fertilizing sites that need additional nutrients than by unnecessarily fertilizing sites that are not deficient. A fertilization scheme for the entire period from planting to harvest follows.

At planting: Use a 1-ounce fertilizer pellet placed where noted in the prior text regarding tree planting.

First year: Sometime during the spring of the first year, apply 0-46-0 in the 3-foot-wide band that was sprayed with herbicide.

This fertilizer contains only phosphorus, which is a nutrient that moves into the soil very slowly. This fertilizer needs to be applied only once during the course of a Christmas tree rotation. By evenly applying 6 to 8 fluid ounces of fertilizer between each tree in the 3-foot-wide row, there should be adequate phosphorus available in future years. If the site is disked or tilled during site preparation, this fertilizer should be broadcast-applied at that time by evenly applying 500 pounds per acre across the entire site before disking.

Second year: In the spring of the second year, apply 2 to 3 ounces of 10-10-10 within a 1-foot circle around each tree. Do not place fertilizer in piles, and do not allow fertilizer to contact the stem of the tree.

Third year: In the spring of the third year, apply 3 to 4 fluid ounces of 10-10-10 per tree within an area that extends to 2 feet away from both sides of the tree, within the 3-foot-wide band.

Fourth and subsequent years: Apply 4 to 5 fluid ounces of 10-10-10 per tree by covering the entire 3-foot-wide band between trees.

Figure 3. Regular maintenance operations, such as shearing, must be performed in order to produce high-quality and marketable Christmas trees. Shearing can be done using hand tools (as shown) or with motorized tools.

Figure 4. A motorized mower, as shown, is an asset to any Christmas tree operation. It can aide control of vegetation in and around the growing trees, and it can be used by the grower to clear alleys and walkways so as to maintain easy access to all areas of the production site.

Economics

Compared to many agricultural enterprises, Christmas tree production does not require large capital expenditures. The cost associated with a Christmas tree planting is a function of the size of the farm, the ruggedness of the terrain, the amount of equipment already owned, and the degree to which growers conduct their own work.

The major equipment needs of a Christmas tree grower include a motorized mower (see figure 4), a backpack sprayer for herbicides and insecticides, tree-shearing tools, and tree-planting equipment. All of this equipment can be purchased for less than $3,000 (in 2009 dollars). Seedling costs can vary from as little as $200 per acre for pine seedlings purchased from the Virginia Department of Forestry to as much as $1,500 per acre for Fraser fir seedlings purchased from private nurseries. In order to keep the plantation growing well and free from weeds and pests, it is usually necessary to treat with fertilizers, herbicides, and insecticides. These costs generally range from $100 to $250 per acre per year.

Revenue from the sale of Christmas trees depends on market conditions, quality of trees, and method of selling. If trees are planted on a 7-foot by 6-foot spacing (1,050 trees per acre), 60 percent of the trees survive and become merchantable, and the wholesale price for trees cut and stacked by the buyer is $15 to $20 per tree, the grower will earn about $10,000 to $12,000 per acre over a seven- to 10-year period. Good growers who increase their harvest efficiency to 80 percent and produce more valuable species such as spruce or fir, which sell for as much as $25 per tree, can earn up to

Summary

Christmas tree production is a viable land-use alternative for some reclaimed mined land. On deep, noncompacted, nontoxic mine soils, all species of Christmas trees common to Virginia can be successfully grown if the grower understands and adheres to the principles of site preparation, planting, weed control, fertilization, and shearing. For people who enjoy occasional hard, outdoor work and understand that producing high-quality trees requires a seven- to 10-year commitment, Christmas trees can be an enjoyable and profitable venture.

References

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Other Virginia CooperativeExtension Publications

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Additional Information

Powell River Project publications; www.cses.vt.edu/PRP/.

Virginia Cooperative Extension; www.ext.vt.edu.

Virginia Tech Soil Testing Laboratory, 145 Smyth Hall (0465), Virginia Tech, Blacksburg, VA 24061; www.soiltest.vt.edu/.

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