

TREE PLANTING
GUIDELINES
FOR
REFORESTATION
COST SHARE PROGRAMS
IN SOUTH CAROLINA



APRIL 2011

South Carolina Forestry Commission

TREE PLANTING GUIDELINES

INTRODUCTION

Planting seedlings on private lands under a cost share program must meet predetermined specifications to qualify for payment. These specifications are designed to protect both the program administrator and landowner in getting a properly planted stand of trees.

The final planting compliance inspection has been designated to be the responsibility of the South Carolina Forestry Commission's Project Forester assigned to the county where the work is done.

Tree Planting Prescription

When the landowner's application for cost sharing has been approved, a tree planting prescription must be prepared. The SCFC Project Forester usually does this; if another forester prepares the prescription, the Project Forester must approve it. The prescription must contain:

1. Number of acres to be planted.
2. Species to be planted.
3. Spacing required- acceptable ranges of number of seedlings planted per acre and or acceptable range of seedling spacing (distance within and between rows).
4. A sketch map- shows the location and boundaries of the area to be planted.

A copy of the planting prescription is furnished to the landowner; it is the responsibility of the vendor to secure a copy from the landowner.

Vendor Responsibilities

1. Contact private landowners to arrange for work to be performed.
2. Secure planting prescription from landowner or forester and perform work as prescribed.
3. Follow proper tree planting procedures to meet specifications in planting prescription.
4. Make arrangements with landowner for seedling delivery.
5. Notify landowner upon beginning of job and at time of completion.
6. Furnish landowner with proper invoice for work rendered.

South Carolina Forestry Commission Responsibilities

The South Carolina Forestry Commission will not engage in any activity that will place the Commission in a third-party position with regard to the accomplishment of cost share work. The Project Forester will not coordinate tree planting activities for private vendors and private landowners.

South Carolina Forestry Commission personnel have the following responsibilities for cost share programs:

1. Encourage and solicit private landowners to participate in the program.
2. Prepare or approve a management plan and cost share prescription for landowners involved.
3. Advise landowners of their responsibilities in completing the work and notifying the South Carolina Forestry Commission and/or the appropriate County FSA or NRCS Office when the work is completed.
4. Upon request furnish the landowner a list of certified vendors available to do the work.
5. Actively work to develop and train new vendors.
6. Inspect completed work for compliance specifications upon notification from the landowner and/or County FSA or NRCS Office.
7. Notify landowner and vendor of any work that does not meet specifications and is not corrected to specifications.
8. Disapprove for cost share payment any job that does not meet specifications and is not corrected to specifications.

Landowner Responsibilities

1. Accomplish the approved practice. Confirm planting prescription with forester.
2. Employ a vendor of choice (if needed) and make arrangements for completing the work, according to the specifications and completion dates. A written contract or agreement is recommended.
3. Make arrangements for purchasing the seedlings needed.
4. Notify the South Carolina Forestry Commission's Project Forester and/or the County FSA or NRCS Office when the planting is begun and when it is completed.
5. Furnish the necessary cost data under the cost share program involved to the South Carolina Forestry Commission's Project Forester as a precondition to the reimbursement process.

Tree Planting Specifications

Tree planting must meet the predetermined specifications before the job can be approved for cost share payment. Planting jobs that do not meet these specifications will not be approved until they are corrected. Foresters will only approve those planting jobs where good planting techniques are used, adequate soil moisture is present, and seedlings planted are in good condition.

Planting specifications are checked for these main factors:

1. Proper care of seedlings *before* planting.
2. Proper pruning of roots before planting *if necessary*.
3. *Number* of seedlings planted per acre (proper spacing).
4. Actual *planting technique* used.

All cost share plantings will be checked according to these Tree Planting Specifications.

Handling of Seedlings

It is extremely important that seedlings receive proper care from the time they leave the nursery to the actual planting in the field. The following guidelines will help ensure against the loss of vigor or even death of seedlings before they are planted:

A. Acceptance at the Nursery

1. Pick up seedlings as close to planting time as possible.
2. Pick up seedlings when weather is cool and humidity is high (>50%); travel in the early morning or early evening.
3. Do not open bags until you are at the planting site.
4. If you must check, open one bag and look for the following signs of poor quality:
 - a. Dry roots
 - b. White root tips (elongation has begun)
 - c. Swelled or burst buds
 - d. Presence of mold on needles or stems
 - e. Sour smell – fermentation
 - f. Bark slips off easily, especially on roots
5. Check for ripped bags or crushed boxes, exposing seedlings to circulating air.

B. Transportation from the Nursery to Local Storage

1. Cover seedlings during transport to shade and protect them.
2. Use racks, spacers, or loading pallets for good air circulation. Make sure at least one side of every box or bag is exposed to circulating air. Do not stack bareroot longleaf pine.
3. Do not park vehicle in direct sunlight.
4. Allow air space between all interior surfaces of the cargo space and the bags or boxes.
5. Secure seedling bags or boxes in cargo space to prevent shifting when traveling on rough roads. Handle carefully at all times. Physical abuse causes respiratory heat and subsequent decline in seedling vigor.

C. Local Storage

1. Unload the vehicle quickly and carefully.
2. Plant the seedlings as soon as possible. Keep temporary storage time at a minimum.
3. Use a cooler if available.
 - a. Keep cooler temperature between 35°F and 38°F and provide continuous monitoring.
 - b. Use facilities with devices that warn of high and low temperatures if possible.
 - c. Make sure seedlings are moist and bags or boxes are well sealed before storage, especially if humidifiers are not available.
 - d. Store bags or boxes on pallets so each container has at least one surface exposed to circulating air.
4. If a cooler is not available.
 - a. Place bags or boxes on north side of a large structure that receives no direct sunlight (radiation), or under the canopy of a very dense grove of evergreen trees (no ground vegetation).
 - b. Cover bags or boxes with a reflective tarp set up as a lean-to. Such a tarp will protect against radiation, provide shade, and allow air to circulate.
 - c. Check bags or boxes for rodent damage frequently and repair rips or tears immediately. Check seedlings to make sure they are still moist and seal bags or boxes tightly.
 - d. Smell inside bags especially those a few days old to see if seedlings have spoiled. Odor will resemble distilled sour mash.

D. Transportation to the Planting Site

1. Make sure the site is ready to be planted (i.e., coastal Bermuda fields need scalping, mechanical site prep areas need to have soil settled prior to planting, etc.)
2. Take only as many seedlings to the field as can be planted that day.
3. Handle bags gently and take precautions to minimize bouncing and sliding around on the bed of the truck.
4. If weather is sunny, windy, dry, or warm, be sure to have something to keep seedlings protected (i.e. water, reflective tarp, damp mulch).
5. Keep seedlings away from fuel and chemicals.

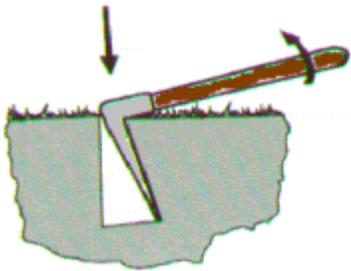
E. Seedling Protection at the Planting Site

1. Never allow planters to sit on bags or boxes.
2. Never place anything heavy on bags or boxes. For example, never use spare tires to keep the protective tarp secure while transporting seedlings from site to site.
3. Park in the shade. **Seedlings must be in a shaded location at all times.**
4. If a pickup with a protective tarp is used and no shade is available, remove the bags or boxes of seedlings from the bed, place them in the shade of the pickup, and cover them with a protective tarp.
5. Keep seedling containers tightly sealed and in the refrigerated van or under the insulated pickup canopy until the planter returns for another load.
6. Open one seedling bag/box at a time; tightly close partially filled bag/box to prevent moisture loss. Repair torn bags with duct tape immediately.
7. Carefully separate roots in seedling bundles to minimize root damage.

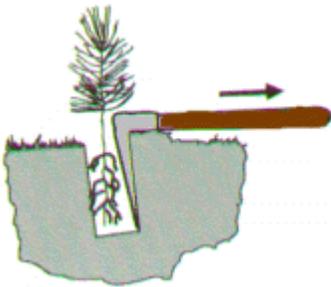
F. Planting - Handplanting

1. Assign inspectors (1 per 5 planters) to planting crews and check for consistency among inspectors.
2. Seedlings must be placed in planting bags so roots are well protected from dry, circulating air.
3. Do not pack seedlings too tightly in seedling pouches; keep them loose for easy removal and minimal damage to young stems and small roots.
4. Keep seedling roots moist (wet mulch), use insulated bags, and only provide planters with enough seedlings to plant for 1 hour on warm, windy, dry days or for 2 hours on warm, calm, humid days. Use one person to distribute seedlings to planters.
5. Use insulated bags that are designed for tree planting.
6. Use a planting tool that is best suited to the seedling roots and the site.
7. **Do not allow planters to field-prune roots.** If root pruning is required, appoint one well-trained and supervised person to do the pruning. (See root pruning guidelines)
8. Do not allow planters to hit or vigorously shake seedlings in an effort to dislodge excess soil.
9. Seedlings should be pulled gently from planting bags to avoid stripping of the roots.
10. Remove trees from the planting bag one at a time and only after hole is prepared.
11. Roots should fall straight down in the planting hole. Do not allow J-, L-, or U-root.
12. Make sure soil is gently, but firmly packed around the root system as the hole is filled.
13. The root collar of a loblolly seedling should be 2 to 3" below the surface. Specifications for planting depth for longleaf pine can be found on page 10.
14. All seedlings in a planting bag should be planted before taking a break.

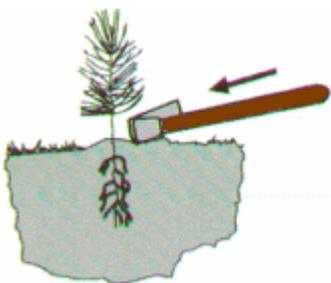
How to Plant with the Hoedad



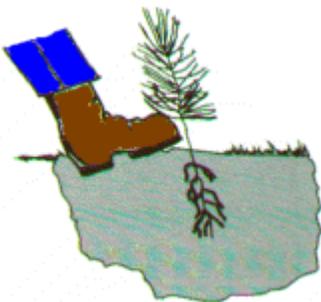
1. Drive blade into soil; lift handle to open bottom of hole.



2. Pull handle toward you, opening top of hole. Set seedling vertically, 2-3" deeper than nursery depth. Longleaf pine planting depth specifications are on page 10.

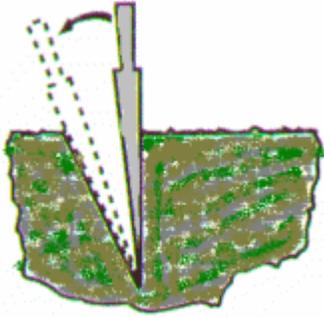


3. Push soil into hole with back of blade.

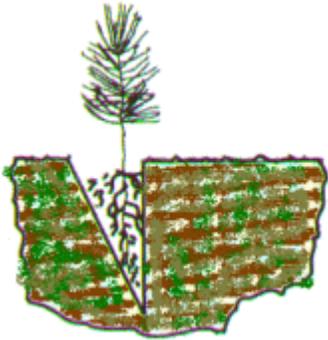


4. Pack soil firmly with your heel.

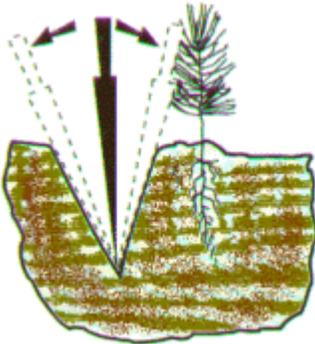
How to Plant with the Dibble



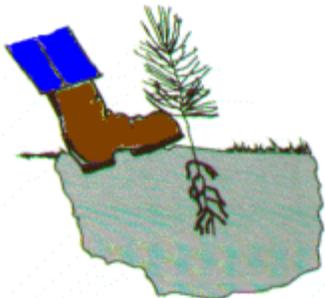
1. Push blade vertically into soil; pull handle toward you to open hole.



2. Set seedling 2 - 3 " deeper than nursery depth; make sure that roots are straight. Longleaf pine specifications are on page 10.



3. Push blade into soil just behind the planting hole; pull handle back to close bottom of hole, push forward to close the top.



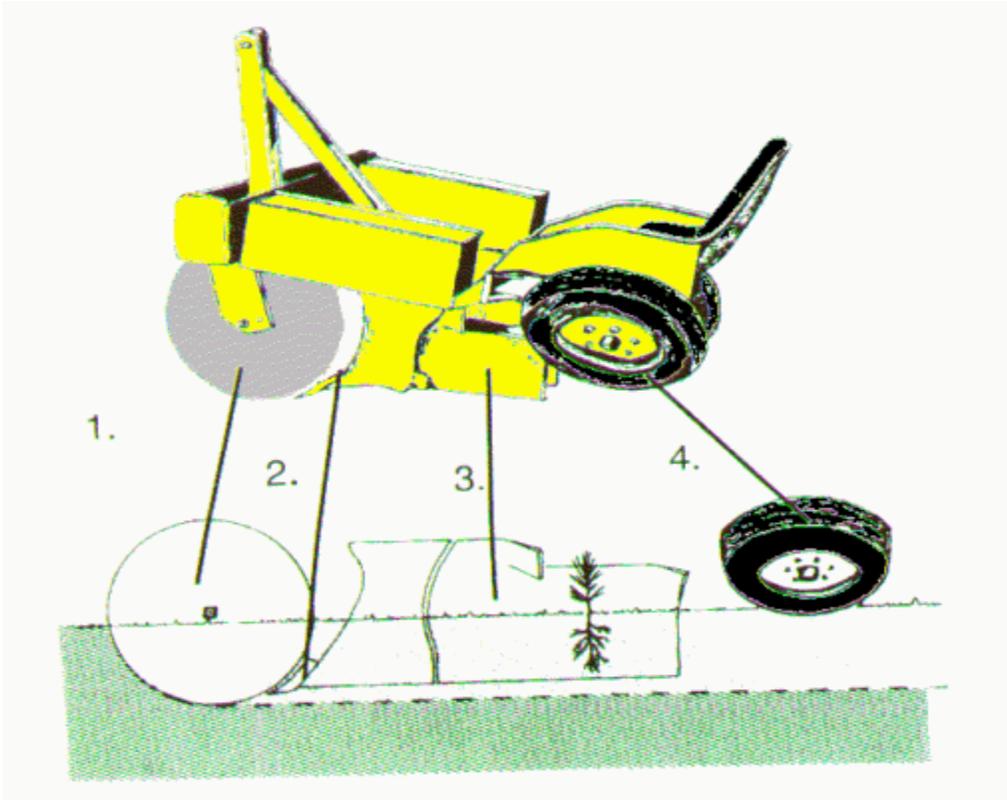
4. Pack soil firmly with your heel.

Machine Planting of Loblolly Pine Seedlings

After the planting machine has been tested and adjusted to the soil type of the site to be planted (this is critical as each planting site is different), the tree planter and tractor driver should plant a row to check for proper depth and packing of the seedlings. Instructions should be repeated for each new operator. The following points should be made:

1. Seedlings must not be allowed to freeze (below 32 degrees) or be left in temperatures above 50 degrees for more than a few hours. Seedlings must be kept cool and roots must be kept moist at all times.
2. Seedlings should be placed at proper depth in the furrow and held until the hand reaches the packing wheels. It is good for the tree setter to gently shake the seedling roots after the seedling is lowered in the trench back of the plow to distribute the root system in a natural manner. The setter should know the depth to plant the seedling regardless of its size. The act of placing the seedlings in the trench must become an automatic operation, since the setter does not have time to look at each seedling and decide its depth. The tractor operator must also determine the best tractor speed by allowing the tree setter to signal the operator for any needed changes in speed. The necessity of having the proper depth of furrow when planting large stock is especially important to ensure that the taproot has enough space to avoid bending.
3. The tractor and driver are important parts of tree planting. An alert tractor driver can contribute to a good overall planting job. He is responsible for straightness of the rows, proper spacing between rows, and speed of the tractor. Tractor speed is an important element in hourly or daily production. A new planting crew should start at a slow rate of speed and increase their speed, as they become more proficient. The setter should acquire a rhythm after some practice so that an average of about 1,000 seedlings is planted per hour. At this speed, about three seconds are allowed to plant each seedling.

How to Plant with the Planting Machine



1. Coultter should cut at least 9" deep. Hub should not drag in the soil.
2. Plow point should run slightly above bottom of coultter furrow.
3. Set seedling in trench 2-3" deeper than nursery depth (loblolly). Roots should be straight and seedling should be vertical. Planting depth specifications for longleaf pine is on page 10.
4. Packing wheels should pack soil tightly around roots, but should not depress soil more than 1 ½ inches.

Keys to Successfully Planting Longleaf Pine Seedlings

- **Order** longleaf seedlings beginning July 1. Contact your forester or the SCFC for a seedling application or a list of longleaf nurseries. The Longleaf Alliance also maintains a list of nurseries that provide longleaf seedlings. You can contact the Longleaf Alliance at 334-427-1029 or visit their website at www.longleafalliance.org.
- **Longleaf pine seedlings can be successfully planted with good results if properly stored, carefully handled, and properly planted.**
- **Containerized or Bareroot Seedlings**—Containerized longleaf seedlings usually have a much better average survival rate than bareroot longleaf seedlings.
 - The best survival rates are achieved when properly **hand planting containerized seedlings**.
 - To increase chances of survival of **bareroot seedlings, machine planting is recommended**.
- **Storage of Longleaf seedlings**—**Bareroot longleaf seedlings should be planted within 2 days of lifting from the nursery**. Containerized seedlings will store better (if kept at 34 degrees F), but still should be planted soon after removal from their trays.
- **Scalping** is highly recommended in agricultural fields and pastures. Even those fields that do not have significant components of perennial grasses may benefit because of the seed-bank of late germinant grasses and broadleaf seeds present in the soil.
- **Planting Depth**
 - **Containerized** – the top of the plug should be visible above the ground.
 - On dry sites that will not be scalped leave ¼ to 1” of the plug exposed (visible above ground).
 - On wet sites (potential for flooding and ponding) that will not be scalped leave 1 ½ to 3” of the plug exposed.
 - On sites that have been scalped leave 1 to 1 ½” of the plug exposed.
 - **Bareroot** – plant with bud ½” under soil surface.
- If machine planting; the coulter should be 32-34” in diameter at a minimum and the foot of the planter should go into the soil deep enough to get at least a 10-inch planting depth.
- Good compaction is needed to eliminate air pockets around seedling roots.
- Use the correct tool when hand-planting. Many containerized seedlings have tools designed especially for certain plug sizes.
- Plant longleaf early in the season. Containerized seedlings can be planted in October if soil moisture is adequate. All longleaf planting should be completed by December 31 if possible.
- Do not plant in dry soils or frozen soils. Moisture must be available.
- Root collar should be size of little finger = ¼ inch or greater (0.25 inches)- any seedlings smaller than this should be culled out.
- A good bareroot longleaf seedling should have at least an 8-inch root system from root collar to the tip of the tap root with numerous well-developed lateral roots. This fibrous root system should be brown in color and not black.
- **Planting longleaf on sites with bermuda grass or other established grasses**
 1. Broadcast spray a recommended herbicide according to label the summer prior to planting.
 2. Scalp rows 2-3’ wide on the planting site at least a month before planting.
 3. Apply herbicides as pre-emergent/early emergent treatments for herbaceous weed control.
- **Planting longleaf on sites where a hardpan exists**
 1. Subsoil or ‘rip’ the hardpan to a depth of 16-18” several months before planting.
 2. Plant 4-6” to the side of the rip; this minimizes seedling mortality and future windthrow.

Tree Planting Numbers to Know

1. Remove seedlings from planting bag one at a time when handplanting.
2. Insert dibble blade 2 times for each seedling planted.
3. **Dibble blade:** 8-10 inches long.

4. **Best planting day (Weather conditions):**

Temperature, maximum: 33°F to 75°F

Relative Humidity: 50%+

Windspeed, maximum: 10 mph

Soil moisture: top 3” of soil is moist

Use extreme care if:

Temperature > 75°F

Relative Humidity < 25%

Wind >15mph

Soil moisture: top 3” of soil is dry

***DO NOT PLANT if soil is frozen or if weather forecast calls for temperatures that will cause the ground to freeze for several days immediately after planting.**

5. **Inside bag temperatures:** 34° to 60°F

6. **Stem thickness at ground line (root collar):**

Loblolly: greater than 1/8 inch

Longleaf: bareroot: greater than 2/5 inch

containerized: greater than 1/4 inch

7. **Stem length (top):**

Loblolly: 8 to 14 inches

Longleaf: 6 to 10 inches needle length

8. **Root length:** 5 to 8 inches. **Do not root prune unless absolutely necessary** (roots are longer than dibble blade). Small seedlings (5 to 8 inch tops) should be root pruned no shorter than 7 inches. Do not prune longleaf seedling roots – lateral roots can be air pruned if necessary.

9. The **number of trees planted** per acre **must be within 50** of the range specified in the plan to be eligible for cost sharing approval. This is to ensure a minimum of 300 well-spaced seedlings per acre are surviving at the end of the first growing season to meet the minimal cost sharing requirement.

10. Seedlings should be planted straight up, leaning no more than 20° from perpendicular to the ground surface.

Root Pruning Guidelines

Seedling roots are **normally** pruned in the nursery bed and **do not need to be pruned** again when planted. However, **if pruning is necessary** for proper planting, the following guidelines must be followed:

1. Longleaf pine seedlings are not to be root pruned.
2. Do not cut the taproot shorter than 5 inches.
3. If exceedingly long laterals are present they may be pruned by pulling them down alongside the taproot and cutting even with the end of the taproot.
4. Protect seedlings from the elements (wind and low humidity) during root pruning. Caution must be **a.** taken during this operation to prevent roots from drying out. **Keep roots moist.**
5. Cut roots with a sharp knife or machete; do not break or twist off by hand.
6. Pruning should be done by one person on the crew to ensure consistency and quality of pruning.

The important factor to remember - there must be an adequate root system to support the seedling.

Handling Treated Seedlings

Some seedlings are treated upon request of the landowner for protection from Pales weevil.

Safety precautions

1. Wear rubber gloves when planting or handling treated seedlings.
2. Do not rub eyes when handling treated seedlings.
3. Wash hands with water and soap after handling treated seedlings. Have wash water and soap at the planting site and other areas where treated seedlings will be handled.
4. Wash hands prior to eating lunch or breaktime.

The pesticides used to treat seedlings are not highly toxic to humans; however, the above precautions need to be followed at all times to minimize ill effects from contact with these seedlings.

SCFC Tree Planting Compliance Checks

To be eligible for cost share payment:

1. A minimum of **eighty percent of the trees** on an area shall be **planted with no planting errors**,

- A. Planting errors include:

1. "J", "L" or "U" rooting.
 2. Loose (will move when 3 needles are pulled to the point of breaking)
 3. Seedling leaning - planted at an angle more than 20° from perpendicular
 4. Planted too shallow (root collar should be level with or slightly below the packed soil surface, but no deeper than the lowest living branch junction).
 5. Top of planting slit open.
 6. Two or more seedlings in planting hole.
 7. Trash in planting slit.
 8. Trees dry when planted (checked when planting was in progress).
 9. Improper root pruning (see pruning specifications).
 10. More than 1% of the seedlings planted are culls.
2. **Number of trees planted per acre must be within ± 50 of the range called for in the plan.** Spacing recommendations are tailored to meet the landowner's management objectives. However, there must be 300 well-spaced seedlings at the end of the first growing season.

Example: Tree planting prescription calls for spacing of 8'x 10' (requiring 544 trees per acre). The trees planted per acre must fall between 494 and 594 to qualify for cost share assistance.

If the Project Forester's compliance check shows the job to be unsatisfactory, the Project Forester will discuss the situation with the Unit Forester before advising the landowner, tree planter, or consultant of the decision. If the Unit Forester agrees the job should be turned down, the Reforestation Program Manager will be contacted to discuss the situation. If necessary, the Reforestation Program Manager will make a field check. If all agree, the landowner and tree planter will be advised of the unsatisfactory planting job.

Tips for Hardwood Tree Planting

HARDWOOD SEEDLING HANDLING AND PLANTING SPECIFICATIONS FOR...

HAND PLANTING

- Seedlings shall be planted using a KBC bar, round-point shovel, or auger in a hole wide enough to accommodate the root system in mineral soil.
- Seedlings will not be removed from planting bag until after planting hole is opened and then no more than one seedling at a time should be removed to help prevent roots from drying.
- The seedling should be planted about an inch deeper than grown in the nursery. That is, the root collar shall be planted at ground line to 2 inches below surface of the soil.
- The shoot and root will be planted vertically aligned. The lateral roots should be spread in a natural manner in the center of the planting hole.
- The planting hole will be closed with the planting tool and the soil firmly packed around the seedling's roots to eliminate air pockets.
- Seedlings will not be planted when surface of soil is frozen.
- Seedlings shall not be root pruned unless approved.

MACHINE PLANTING

- Adjust planting foot to run at minimum depth of 10 inches. Do not plant with foot raised to reduce drag or avoid bogging. If ground is too wet to run foot at 10", wait for a drier time. If planting foot is worn to the point of being too short, replace the foot.
- The seedling root collar will be planted at ground line to 2 inches below surface of the soil.
- The shoot and root will be planted vertically aligned, with no lateral roots exposed.
- Adjust **packing wheels** to completely close planting trench from top to bottom. **Adjustments may be needed as soil type and moisture changes.**
- Use tractors and planting machines of sufficient size and weight to insure proper planting and packing is done. When planting in heavy soils a light tree planter will not be sufficient.
- Take care in not damaging seedlings by improper handling or improperly aligned packing wheels.
- Seedlings must be kept in seedling trays on planting machine, or in their original container, so the roots are well protected from dry, circulating air(wind). **Roots of seedlings must be kept moist.**
- All seedlings should be planted within two hours of the time placed on the planter.

HARDWOOD TREE PLANTING PRESCRIPTION

1. Rip planting area the fall prior to planting (**subsoiling**) (ag fields or pasture only). Allow time for the subsoiled area to settle before planting. Plant seedlings 4-6" from the subsoil trench.
2. Plant during the winter while seedlings are dormant.
3. Apply preemergent herbicide before bud break if needed.
4. Apply herbaceous weed control during the growing season if needed.

Hardwood Tree Planting Numbers

Hardwood Seedling Specifications

- 6 mm or 1/4-inch minimum root collar diameter for white oak, willow/water oak, water tupelo, baldcypress, and overcup oak.
- 7 mm or 3/8-inch minimum root collar diameter for swamp chestnut oak, cherrybark oak, green ash, sycamore, sweetgum, yellow-poplar, and black walnut.
- 24-inch minimum shoot height.
- Five or more first order lateral roots present below ground line. 8-inch minimum length for roots.
- 3/8 inch minimum top diameter and 16-inch minimum length for cottonwood cuttings.
- Seedlings not forked at ground line.
- Seedlings with no signs of disease or damage.
- Seedling root collar will be planted at ground line to 3 inches
- The shoot and root will be planted vertically aligned, not to exceed 20° angle.

Recommended Hardwood Spacings

<u>Spacing</u>	<u>Trees per Acre (tpa)</u>
10' x 10'	435
12' x 12'	300
15' x 15'	200

Site Specificity-match species with soil conditions

Use local seed sources that are best adapted to the sites in your area.

OAKS

- *Cherrybark, Shumard, and Swamp Chestnut Oaks* do best on well-drained river terraces; requiring deep loamy soils with a moisture retaining capacity in the subsoil.
- *Willow, Water and Pin Oaks* do best on moderately drained flats.
- *Overcup Oak* tolerates more flooded conditions.
- *Northern Red Oak* prefers well drained, but moist sites on northern exposures without a fragipan.
- *White Oak* likes mid-slopes intermediate in soil moisture and fertility.

OTHER HARDWOODS

- *Cottonwood* requires full sunlight for good survival and growth; can withstand some periodic flooding.
- *Green Ash* has intermediate tolerance to shade and can withstand periodic flooding from January to May.
- *Yellow Poplar* does not grow on flood plains of rivers that flood periodically for several days at a time; prefers well-drained deep, rich soils (river terrace). Also, occurs in rich loamy coves of the mountains.
- *Sycamore* likes well-drained deep, rich soils; but can survive on shallow, sandy loamy soils over a clay base in the coastal plain. In the piedmont, sycamore is found on the river terraces as well as the deep loamy soils of upland slopes and ridges where little erosion has occurred.

Certified Vendor List

The SC Forestry Commission will prepare a list of certified tree planting vendors. To be placed on the vendor list the vendor must do the following:

1. Attend one of the SC Forestry Commission's training sessions, or an orientation and instruction by the local Unit Forester.
2. Complete 'Request for Placement' form to be on list by providing information requested.

The Forest Management Section Chief may remove a vendor from the list after two jobs fail to meet specifications and are not corrected to specifications as documented on the Tree Planting Compliance Report. A vendor, once removed from the list, can be readmitted to the list after twelve months by making a request through the Forest Management Section Chief.

Once certified, a vendor may remain on the list for a 3-year period, then must be recertified or can be removed for cause.

SC Forestry Commission foresters will only recommend certified vendors. Individuals and vendors not on the list can do cost share planting. However, they must meet the same specifications as described in these guidelines to qualify for payment.