



Longleaf Note #7: Planting Longleaf Pine in Old Fields or Pastures

In Longleaf Note #6, we covered some of the basic steps necessary for successfully planting longleaf pine on cutover sites. In this article we will address some of the additional or different practices that may be required for a successful longleaf planting on an old-field or pasture site. As we examine the techniques required, it will become obvious that most agricultural sites are more challenging, but certainly not impossible, to convert back to longleaf pine with proper care and planning.

The biggest differences between cutover sites and agricultural sites are changes in soil properties and herbaceous competition due to soil tillage, fertilization, liming, herbicide application, and establishment of perennial pasture grasses. In a few cases, the site may be unsuitable for any pine species.

Importance of Site Preparation

Selecting the correct method(s) of site preparation is critical for both survival and growth of longleaf pine seedlings in agricultural fields or pastures. The method selected will depend on cropping history, herbaceous species present or anticipated on the site, slope, and soil moisture conditions.

In general, if perennial grasses are present, the first step is a chemical site preparation. Bermuda, Bahia, centipede, and fescue grasses should be sprayed with a high rate of imazapyr (Arsenal® or Chopper®) or glyphosate (Roundup® or Accord®) prior to planting. Unless the site is deep well-drained sand, or an exceedingly wet site, the site should probably be scalped.

Scalping is a mechanical process whereby the soil is peeled back in a wide (30-36") shallow (2-4") furrow. A site can be scalped with a machine specifically designed for this purpose. More frequently, fire plows are used because they are readily available. Since scalping is not breaking up a plow-pan or hardpan, it does not require a large tractor to pull the scalper or fire-plow.

Ripping or sub-soiling, on the other hand, produces a deep (14-20") narrow (2-4") trench that is designed to break up a hardpan or plow-pan. It takes significantly more horsepower to rip an agricultural field than it does to scalp an old-field or pasture.

Researchers with the Florida Division of Forestry and the USDA Forest Service examined the effects of scalping in the 1990's. They conducted studies with both slash pine (Barnard et al 1995a) and longleaf pine (Barnard et al 1995b) on agricultural sites in five counties in Florida. These studies demonstrated that both longleaf pine and slash pine survived at greater rates and grew faster on converted agricultural croplands when the sites were scalped before planting. Scalping outperformed Benomyl® root dips, herbaceous release, a disking site preparation, and insecticide applications.

Dr. Ed Barnard and others with the Florida Division of Forestry concluded that scalping is beneficial to newly planted pines. They cited the following benefits of scalping:

1. Reduced weed competition,
2. Improved moisture relations,
3. Reduced pressure from certain root pathogens,
4. Reduced insect damage, and
5. Possibly improved planting efficacy.

First and foremost, we believe scalping helps control competition during the first growing season. A scalping site preparation is extremely beneficial for any seedling planted in perennial grasses. Some of the most competitive perennial grasses are Bermuda grass, Bahia grass, fescue, and Johnson grass. Rhizomes and root systems from these species are severely reduced or eliminated in the scalping furrow. Seedlings planted in the scalping furrow have a greater window of competition-free growth when pasture grasses are not herbicided before planting.

Many people fail to see the benefits of scalping a site that was in row-crop production the year prior to planting. However, we have found that scalping reduces competition even in fields that do not have significant components of perennial grasses. Whether you realize it or not, there is a time bomb lying in these old fields. In this case, the time bomb is the seed-bank of late germinant grasses and broadleaves.

Scalping peels back the upper layer of soil where a large portion of the annual weed seed bank resides. Removing this seed bank reduces the number of weeds that will germinate in the area immediately surrounding the newly planted seedling. By reducing late germinant competition, a single herbaceous release will frequently provide season-long weed control. To be successful in these old fields and pastures, new seedlings require one season of good competition control. Scalping combined with the proper herbaceous release will usually yield this result.

As with all forestry practices, there are potential negatives to scalping. If the soils are very wet, or the soils are very heavy (high clay content), scalped rows may hold water and drown the seedling. The major negative associated with scalping is the potential for increased erosion. It is critical that scalping, ripping/sub-soiling, and mechanical tree planting follow the contour of the land. Otherwise, there will be an unacceptable amount of erosion.

There is a strong likelihood that seedlings planted in scalped rows will end up exposed or buried if: the scalping site preparation is too deep, the scalped rows do not have time to settle prior to planting, scalping is not done with the contour of the land, or seedlings are not planted at the usual planting depth in the scalped rows. For best results, scalp and rip the site several months prior to planting. The more rainfall prior to planting, the more the site will settle out and the less likely your seedlings are to be buried or washed out of the planting furrow.

Never plant directly in the rip. Instead, plant a few inches to the side of the rip on the “shoulder” of the scalped row. Mechanical tree planting is a viable option on some sites, especially with bareroot seedlings. However, we have had better luck hand-planting container-

grown seedlings on our sites.

Plant shallow! One of the leading causes of longleaf planting failures is deep planting. If the terminal bud is covered the spring following planting, the seedling will probably die. Deep planted seedlings that do survive languish in the grass stage for years and years while surrounding seedlings planted at the correct depth put on three feet or more height growth a year.

On most sites, soil moves away from newly planted tree seedlings. In scalped rows, the soil moves onto the seedling. For this reason, it is recommended that container longleaf seedlings be planted approximately 1" shallower in scalped rows. It is preferable to have the terminal bud 1-2" above the soil surface at the time of planting. This means the plug will be exposed at the time of planting. In two separate studies conducted by the Longleaf Alliance, container seedlings planted with the plug $\frac{1}{2}$ " to 1" above the soil surface in scalped rows survived and grew better than those planted with the plug covered. **The results of numerous studies conducted by the Longleaf Alliance indicate that planting with the plug exposed has no significant detrimental effect on either survival or growth of longleaf pine seedlings.** The consequences of planting too deep far outweigh the perceived negatives of shallow planting.

If the area is not scalped, an ideally planted seedling will have the plug slightly covered and the terminal bud exposed the spring following planting. If the terminal bud is covered, the seedling is too deep. On these un-scalped areas you should consider planting the seedlings with the plug at or slightly above ($\frac{1}{4}$ - $\frac{1}{2}$ ") the soil surface.

Broadcast Chemical Site Preparation

If perennial pasture grasses are present on the site, a chemical site preparation may be necessary. If the landowner wants to retain the grasses with the longleaf pine, then scalping and or sub-soiling are sufficient for your site preparation. A good example is where some landowners plant longleaf pine in pastures with the intention of grazing cattle in the future (silvopasture).

If perennial grasses are unwanted, they should be eliminated or controlled through the site preparation. In general, mechanical methods are ineffective at controlling perennial pasture grasses. Disking or plowing Bermuda grass does not control Bermuda. Bermuda grass will reclaim the site the spring following planting. Once longleaf seedlings are in place, it is very difficult to control Bermuda grass.

Bermuda grass can be sprayed with high rates of Accord SP® or Roundup® (usually 5 quarts/acre) when the grass is actively growing. Alternatively, some people have had better luck with Arsenal® (usually 24 oz/acre) or Chopper® (usually 48 oz/acre). With glyphosate products (Accord SP® or Roundup®) there is no time delay in planting. You can spray in the morning and plant the same site that afternoon. With imazapyr products (Arsenal® and Chopper®) several weeks must pass between the herbicide application and planting your

longleaf pine seedlings.

Bahia grass and fescue are more easily controlled than Bermuda. Usually, 3 quarts of Accord SP® or Roundup® will kill these grasses with a single application. As with Bermuda grass, make sure to spray the chemical while the grass is actively growing. Do not spray in the middle of a drought. Do not spray while heavy dew is still on the grass. And, time the application so the chemical has time to dry before any subsequent precipitation.

Dr. Thomas G. Barnes with the Department of Forestry at the University of Kentucky reported on his research killing fescue in the February 2002 issue of *Wildlife Trends*. Dr. Barnes found that imazapic at 12 oz/acre with a surfactant was effective at killing fescue. He suggested that imazapic be applied while the fescue is actively growing and about 4-6" in height.

For more information on controlling Bermuda, Bahia, or fescue grasses, review the articles authored by Dr. Barnes and Dr. Washburn in the February issue of *Wildlife Trends*.

Special Cases

Extreme Competition – In agricultural fields and pastures, many problems with survival and growth relate back to competition. The severity of the competition is related to the weed species composition and the fertility of the site. The more fertile the site, the more difficulty you may find in controlling herbaceous weed competition. Furthermore, weed species encountered on agricultural sites are often more aggressive than on cutover sites. Where a single herbicide application is typically sufficient on cutover sites, multiple applications are sometimes necessary on agricultural fields.

In many areas, scalping will take the place of at least one herbicide application. On areas where we have applied a scalping site preparation, a single pre-emergent herbaceous release is usually sufficient for season-long weed control. An exception to this rule is areas with Bermuda grass, which will quickly invade scalped areas with runners. Where Bermuda grass is present, a second herbicide application should be considered in or around mid-May. Arsenal at 4-6 oz or a labeled grass herbicide applied over the top should help to slow the Bermuda grass down and allow the longleaf to survive the first growing season.

Annual introduced grasses are oftentimes the worst competitors in agricultural sites. It is not uncommon to find longleaf survival rates of 10% or less beneath crabgrass. Any grass that grows rapidly and forms a "mat" or "carpet" has the potential to severely reduce longleaf seedling survival. If uncontrolled, both crabgrass and Bermuda grass (a perennial) will form mats that blanket the seedling. The root systems of the grasses compete for water and nutrients while the aboveground biomass covers the seedling, reducing the seedling's access to sunlight.

Crabgrass, buffalo grass, and other annual grasses are late germinants. These species will not be controlled by early season pre-emergent herbicide applications. If these species are

present, at least one follow-up application of Arsenal®, Envoy®, or another grass herbicide should be applied shortly after the grasses start germinating. Don't wait too long. Generally, grass herbicides are most effective if applied the first couple weeks following germination. Typically, we will apply our second round of herbicides in or around mid-May to control crabgrass and/or residual Bermuda grass.

Basic (Non-Acidic) Soils and Residual Herbicides – With few exceptions, forest soils in the Southeast are acidic (below 7.0 pH). One exception is the “black belt” where some prairie-type soils occur in central Alabama. Otherwise, forest soils typically have a pH somewhere between 4.0 and 6.0.

All southern pine species are adapted to acidic soils. As the soil pH increases and the soils become basic (above 7.0), southern pine species may have difficulty obtaining some nutrients from the soil. Observations of newly planted bareroot loblolly, slash, and longleaf in a heavily limed pecan orchard, revealed a consistent pattern of yellowing, reduced root growth, and increased mortality among newly planted seedlings in basic (above 7.0 pH) soils.

Likewise, complete planting failures are not uncommon on agricultural sites that were formerly used for tomato production. Southern Forestry Consultants report that some tomato fields in and around Thomasville, GA and Quincy, FL were limed so heavily the soil pH exceeded 8.0. Under these conditions, it may be extremely difficult to establish any pine species.

Furthermore, one of the most frequently used chemicals applied as an herbaceous release over longleaf pine - Oust® or sulfometuron – appears to behave differently based upon soil pH. As pH increases, sulfometuron becomes more active. In general, we recommend reducing the rate at which Oust® is applied when pH exceeds 6.0, and Oust® should probably be avoided when pH exceeds 6.5.

Therefore, a good first step is to sample the soil of the old-field or pasture you intend to convert to longleaf pine. If the soil pH exceeds 7.0, you may encounter increased risk of planting failures.

While many planting failures that once fell under the category “unexplained” have been tracked back to high soil pH, another potential factor in “unexplained” planting failures may be residual herbicides. Most agricultural herbicides decompose fairly rapidly, and are probably not a factor in seedling mortality. Other herbicides may stick around long enough to be picked up by newly planted pine seedlings. A variety of herbicides are used over agricultural crops and it is difficult to track down which ones are responsible for increased mortality of pine seedlings. To avoid the possibility of residual herbicides damaging your newly planted tree seedlings, it may be wise to let crop ground lay fallow for one year following peanut or cotton production.

Wet Sites with Anaerobic Soil Conditions – After determining the suitability of the site in regards to soil pH, it is a good idea to look at soil drainage and water tables. If the soil remains saturated for much of the year - creating anaerobic conditions (low or no oxygen in the soil),

increased mortality should be anticipated.

Many fields have “wet spots” at lower areas in the field. In these low areas, your objective should be to keep the terminal bud above the water level. A seedling planted with even a little soil covering the terminal bud will rot and die quickly in saturated soil. Bedding is probably your best alternative for site preparation in wet spots. Also, when using container-grown seedlings, plant the seedling with the plug protruding above the surrounding soil surface. It is virtually impossible to plant container seedlings too shallow in these wet sites. Even with bareroot seedlings it is advisable to plant with the root collar well above the soil surface. If bedding is an option, try planting the seedling with the root collar about ½” above the soil surface. If bedding is not an option on excessively wet sites, try planting container-grown seedlings with the root collar approximately 2-3” above the soil surface.

Dry Sites with Excessively Drained Sandy Soil – In some cases, poor sandy soils have become uneconomical to farm given recent commodity prices. Consequently, many farmers have been converting poorer fields to CRP pine plantations. In general, longleaf pine is the only species that will grow at an acceptable rate and also produce high quality wood products on the poorest soils. Some examples of deep well-drained sands are Lakelands, Troupes, Bigbees, and Kershaws. Luckily, these soils can also be some of the easiest sites on which to establish longleaf pine.

If the site does not have a history of weed competition from Bermuda grass, buffalo grass, crabgrass, or other problematical grasses, then no site preparation may be necessary. Some of the best plantings we have seen were either bareroot or container seedlings planted without site preparation. On these excessively drained sandy soils, it may be unnecessary to apply an herbaceous release the spring following planting.

If competition is expected on the site, then a low rate of Oust®, Oustar®, Arsenal® or another labeled herbicide can usually be applied in a single, banded application. In the absence of late germinants, this should be sufficient. On sites where annual or perennial grasses reappear following the first application, a second application of Arsenal®, Envoy®, or another grass herbicide may be applied as necessary.

Excessive Soil Nutrients – Some agricultural sites have received numerous applications of chicken litter. The Longleaf Alliance has observed several sites with histories of frequent chicken litter applications where longleaf plantings have been abject failures, with survival rates ranging from 0-10%, one or two years post planting. It is a good idea to test agricultural fields for soil macro and micro-nutrients before planting. Consider pastures with repeated chicken litter applications or sites that had cattle catch-pens/ corrals to be areas of particular interest. Excessive soil nutrients often lead to near complete mortality of planted pine seedlings.

Inter-planting – The most challenging situations faced by foresters, farmers, and tree planters are sites that had partial planting failures. If the initial planting was a total failure, then one has the option of starting over with a good site preparation, or walking away from the site and

cutting your losses. However, if you have 100 or 200 seedlings surviving out of the 500 originally planted, what is the next step?

It is important to look at the reason your seedlings died in the first place. Was mortality a factor of a poor planting job, planting too late in the season, poor quality seedlings, residual herbicides used on a previous agricultural crop, or the wrong herbaceous release applied during a drought? These are problems that can be avoided in subsequent inter-plantings.

If, as in the previous 3 years or so, the seedlings died from severe spring and summer droughts, we can only hope that rainfall occurs more frequently next time.

However, if you planted good quality seedlings, at the right depth, early in the planting season, received adequate rainfall, and applied the correct herbaceous release, then your seedlings probably died from severe competition or extreme site conditions. More than likely mortality could have been reduced through the use of a different site preparation. Scalping is almost always beneficial where severe competition is expected. Bedding could raise longleaf seedlings out of the water on wet spots. If some type of site preparation is not applied in these areas prior to inter-planting, expect high mortality rates with follow-up plantings.

Typically, we recommend one of two options for landowners inter-planting their agricultural fields. The most common method is to hand-plant container-grown seedlings in spots where seedlings died. This keeps spacing consistent throughout the stand and does not complicate future management decisions. Inter-planting within the original rows is a viable option as long as you are not planting directly into a perennial grass such as Bermuda or Bahia grass.

If perennial grasses are present, then we recommend scalping between or beside existing rows and planting in the scalped area. This maximizes the seedlings' survival rates and should yield an acceptable stocking level. Unfortunately, the altered spacing may complicate follow-up management of the stand, especially herbaceous release and harvesting operations.

Keep Informed

The Longleaf Alliance conducts research examining herbaceous release, seedling quality, container style, planting depth, site preparation, and many other aspects of both artificial and natural regeneration of longleaf pine. To keep abreast of the most current knowledge, consider joining the Longleaf Alliance. If you intend to plant longleaf pine in the near future, consider purchasing our 46 minute video, *Artificial Regeneration of Longleaf Pine*. For more information about the Longleaf Alliance, or to acquire information on seedling availability, planting depth, summer planting, herbaceous release, or any other aspect of longleaf pine management, please call us at 334-427-1029 or, visit our website at: <http://www.longleafalliance.org>

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