Shortleaf Pine INITIATIVE

Fertilization Management

Andy Scott, Soil Scientist,
USDA Forest Service

Shortleaf pine generally competes best with hardwoods or other pines on dry, shallow, infertile, and rocky soils, although it achieves its best growth on more fertile, deeper soils.[8] While shortleaf pine will respond to fertilization on many sites, it will not respond as dramatically as loblolly or slash pine, and will not reach similar early growth rates. In addition, fertilizing shortleaf stands at incorrect times can reduce survival and increase undesired species. Furthermore, the entire management regime of the stand (stand density, prescribed fire, chemical vegetation control) should be considered. Thus, shortleaf pine nutrition management should be considered in relation to the overall goal and purpose of the stand in question.

Figure 1: Fertilizing this young shortleaf stand would increase the hardwood and herbaceous competition surrounding it, thereby reducing growth and survival of the shortleaf pine (noted by yellow circle). Credit: Andy Scott

Shortleaf pine stands are often managed for multiple goals, such as timber, wildlife habitat, native plant understories, or agroforestry, and nutrition recommendations vary widely for each of these conditions. Below are separate recommendations for each component, but a final decision should incorporate understanding of all desired and undesired effects.

Nutrition for Timber Management

Fertilizers can be added to increase shortleaf pine growth rates just as is commonly done for intensive loblolly and slash pine plantations. However, shortleaf is less nutrient-demanding than loblolly pine, and it does not respond as strongly to fertilizer. Very little empirical research has been conducted with fertilized shortleaf, so long-term growth rates and variations in response across its range are not well known. Current soil groupings for loblolly and slash pine fertilization recommendations, such as the CRIFF groups, do not exist for shortleaf pine. Until these types of data are available, recommendations are similar to those for loblolly pine, but with less certainty of response. Generally, fertilization is only recommended on fair to good sites; trees on shallow, rocky, or very dry soils will not likely respond. Trees on deeper soils with low organic matter will respond the best to fertilization.

Fertilization at Planting or Sapling Stage

Fertilization at planting will rarely improve seedling growth rates unless the site is excessively infertile, such as a soil phosphorus (P) deficiency. This is because seedling nutrient demand typically does not exceed soil nutrient supply. In fact, fertilizing at planting often reduces survival and early growth of seedlings due to the increased competition from hardwoods and

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NORTH CAROLINA FOREST SERVICE
Southern Regional Extension Forestry

Figure 2: Nitrogen deficiency in loblolly pine. Credit: Larry Morris

herbaceous plants (Fig. 1).[1] For this reason, nitrogen (N) fertilization is not recommended at planting. If, however, soil tests (or foliar tests of seedlings) indicate that the trees are exceptionally P deficient, 25–50 lbs. of P applied at planting or within the first 5 years will ameliorate the deficiency.[5] The P can be applied as 0–46–0 or 18–46–0, especially after age 4–5 when the trees should be competitive with the herbaceous plants. Tree height will increase if trees were P deficient.

Fertilization at Canopy Closure

Fertilizing shortleaf stands after full canopy closure can dramatically increase growth.[3] Because fertilization at this time increases growth through increasing leaf area, stand density needs to be managed through thinning to ensure the crop trees have room to expand. The majority of growth increases at this stage are in diameter growth of the tree stem, not height growth. Rates of 200–225 lbs N and 25 lbs P per acre (125 lbs of DAP 18–46–0 and 400 lbs urea 46–0–0 per acre) are recommended based on studies of loblolly and slash pine.[5] The most effective rates for shortleaf may be less than this due to shortleaf's relatively smaller response to fertilizer, but until data is available these rates are a good estimate.

Fertilizing Older Stands

Fertilizing older stands, especially those not previously fertilized, may be useful to improve diameter growth rates and to mitigate the impacts of littleleaf disease. When combined with thinning, later fertilization will help shortleaf grow into larger, more valuable sawtimber classes. The final harvest should be delayed for 6 to 8 years to realize the full growth and financial benefit of the fertilizer application. Similar rates as for canopy closure are recommended. Littleleaf disease greatly reduces the ability of tree root systems to take up nutrients, especially N and Ca. Fertilizing littleleaf sites does not eliminate the disease, but if stands are exhibiting some growth loss due to littleleaf, fertilizing with N can mitigate these growth losses to some degree and maintain a stand long enough for it to attain merchantable size.[11] In stands exhibiting littleleaf disease, fertilize one time with 1 ton of 5–10–5 and 1/2 ton ammonium sulfate per acre[10] or fertilize with 400 pounds of 5–10–5 per acre every 4 years.[4]

Shortleaf Pine for Ecological Wildlife Habitat

Shortleaf pine forests provide excellent wildlife habitat for both game and non-game animals, and soil fertility can be managed in some cases to improve this habitat. Care must be taken because changing soil fertility through fertilization has a strong, and perhaps unwanted, effect on species composition.[7]

If the primary goal is to restore native grass and forb understories, such as for quail habitat or simply for biodiversity, fertilization of any sort is not recommended, especially if the understory is in the process of being restored.[13] Native grasses and forbs are generally adapted to the soil conditions present on the site and increased nutrient availability often encourages less-desirable species. Non-native plants and native weeds are generally not adapted to these conditions, and they tend to respond aggressively to fertilizer applications. Not only does this increase the growth and presence of non-native invasive plants, but they out-compete the native plants. Furthermore, fire is commonly prescribed to help restore the native understory, and over time, these restored systems have more fertile soil than their un-restored counterparts.[9]

In forests with established understories, or where species composition is of less importance, fertilization can improve forage quantity and quality nutrition for game animal grazing. Fertilizing the main stand after thinning provides the dual benefit of increasing forage as well as pine growth, but this would not be a cost-effective treatment for specifically improving forage quality. If the primary goal is wildlife forage, then open areas, roadsides, and honeysuckle or blackberry patches can be fertilized to provide increased forage quality.[2] For these limited areas, most forages would benefit from applying lime at 1–3 tons per acre and then a complete fertilizer (13–13–13) treatment at 400–500 lbs per acre rate in the spring and 100 lbs per acre of ammonium nitrate (34–0–0).[4]

Shortleaf Pine for Ecological Wildlife Habitat

Finally, shortleaf pine woodlands can be managed as silvopastures for grazing domestic animals, such as cattle, sheep, or goats.[6] See Silvopasture Management for more information. Specific fertilization recommendations for forages is highly dependent on soil type, climate, and forage type. Recommendations are available through your local state extension agencies. Secondly, shortleaf pine alleycropping with switchgrass[12] can provide short-term income if a switchgrass biomass market is available as well as long-term timber income. Similar to silvopastures, any fertilization would be done primarily to manage the switchgrass.

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