Sampling Loblolly, Longleaf, and Slash Pine Foliage for Nutrient Analyses

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Foliage sampling loblolly, longleaf, and slash pine to determine nutrient status can be used as a diagnostic tool to aid forest landowners, forest consultants, and resource managers in making sound fertilizer prescriptions for pine plantations. Other diagnostic tools such as leaf area index (LAI) (for loblolly and slash pine) and soil sampling (testing for primarily plant available-P) provide additional information on the nutrient status of the stand. These diagnostic tools along with information on:

- short- and long-term landowner management objectives,
- soil series/group descriptions,
- soil drainage classes,
- tree species,
- stand age,
- stocking,
- years to a thinning or final harvest,
- percent fusiform rust incidence,
- hardwood basal area present

are important to make a biologically & economically sound fertilization prescription.

Foliage sampling of loblolly, longleaf, and slash pine should be done in the following manner to ensure that the results from the UGA Soil, Plant, and Water Laboratory or other laboratory accurately represent the nutrient status of your pine stand.

Tools required are:

- pruning pole for collection in young stands (tree heights to 20 feet)
- 12 gauge shotgun with full/extra full choke and high brass (express or magnum) 11/8 to 11/4 ounce loads of # 6 shot for older stands (tree heights greater than 20 feet)
- a clean (no soil or grit) bucket or large paper bag
- a sample bag for each stand. County Extension offices can provide plant sample mailing kits for the UGA Soil, Plant, and Water Laboratory
- a cooler/ice chest to keep samples during transport
- Sample in dormant season only (after hardening off and before bud break); typically from mid-December to February 1 in the Coastal Plain or to February 15 in the Piedmont avoiding extended warm spells.
- Sample at least 6 (smaller stands) to 10 (larger stands) dominant trees per stand (tallest trees with good form and crown).
- Sample from the upper 1/3 of crown on the south side (Photos A-C).
- Foliage samples should be taken from primary lateral branches; collecting needles from the first flush of the past season's growth (Photos D-F). Longleaf generally has only 2 growth flushes/year (picture H), while loblolly and slash pine (Photo I) may have 2 (droughty growing season) to 3 (in good growing season rainfall year) or 4 (rarely) flushes/year.
- Clip or shoot branch below desired flush and strip needles including needle sheaths/fasicles from the branch (Photo G).
- Mix the foliage samples in bucket or paper bag. Take a large handful (200 or more needles, free of soil and branches) from the bucket/bag and put in plant sample bag. Properly date and label the sample bag to the corresponding stand. Do not put foliage samples in plastic bags and do not submit wet samples. If sampling wet foliage, spread foliage samples on a table covered with newspaper and let air dry for a day.
- Transport samples in a cooler with frozen jugs of water to keep samples cool and dry.

Submit samples with all paper work filled out to County Extension Service office or private lab in a timely manner. Keep samples cool (refrigerate but do not freeze) if storing samples prior to County Extension office or lab submission.

- When you receive the laboratory results, compare the nutrient levels with Table 1 to determine nutrient status. For additional stand information to formulate a prescription see:

Fertilizing Pine Plantations: *A County Agents' Guide for making Fertilization Recommendations*
http://www.bugwood.org/fertilization/csoillab.html

Table 1. Foliar nutrient sufficiency (minimum) guidelines for loblolly, longleaf, and slash pine

Nutrient	Loblolly pine[a]	Longleaf pine[b]	Slash pine[a]
	---------- percent ----------		
Nitrogen (N)	1.2	0.95	1.0
Phosphorus (P)	0.12	0.08	0.09
Potassium (K)	0.30	0.30	0.25 – 0.30
Calcium (Ca)	0.15	0.10	0.08 – 0.12
Magnesium (Mg)	0.08	0.06	0.06
Sulfur (S)	0.10	--	0.08
	---------- parts per million (ppm) ----------		
Boron (B)	4 - 8	--	4 – 8
Copper (Cu)	2 - 3	--	1.5 – 3
Iron (Fe)	20 - 40	--	15 -35
Manganese (Mn)	20 - 40	--	20 – 40
Zinc (Zn)	10 – 20	--	10 – 20

[a] Allen (1987); Jokela (2004); Pritchett and Comerford (1983); Wells, Crutchfield, Berenyi, and Davey (1973).

[b] Blevins, Allen, Colbert, and Gardner. (1996) for N, P, K, Ca, and Mg. No literature available to date for longleaf sufficiency for S, B, Cu, Fe, Mg, or Zn.

Literature Cited:

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A. Choosing a dominant tree for foliage collection, sampling with pole pruner.

B. Using shotgun for sample collection.

C. Upper third of crown - sample branches.

D. First flush of previous year's growth on primary lateral branch.

E. Collecting first flush of foliage.

F. First flush removed.

G. Foliage sample.

H. Longleaf pine - first flush is closest to hand with needle angle almost 90^{o} to branch.

I. Slash pine with first flush removed.

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