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## **Proper Soil Sampling and Analysis for Nutrient Needs Determination in Loblolly, Longleaf, and Slash Pine Stands**

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13 September 2010

Most land-grant universities have Agricultural Service Laboratories that perform testing for soil and foliar nutrients. Call your county Extension office to see if they provide soil and foliage testing services. If so, get several soil boxes or bags from the nearest office. Some private labs can also perform these analyses. Both soil and foliage tests can indicate if a nutrient is below a “critical level”, “sufficiency level”, or “minimum guideline” which assumes that a stand will respond to fertilization of that nutrient. These “critical levels” are determined from field or greenhouse trials. There are cases where a nutrient or nutrients are determined to be below sufficiency but other stand (level of competing vegetation, high pine basal area) or site (low nutrient and water holding capacity soils, shallow soils) limiting factors prevent the pines from responding to the added nutrient(s).

Soil sampling can be done any time of year. The tools required to sample soil are a clean 1 to 5 gallon plastic bucket (avoid metal buckets), a soil probe or narrow shovel or hand trowel, and soil bags or boxes (a backpack or planter’s bag is convenient where many soil sample boxes will be filled and the walk is long or the bucket can be used to transport the soil samples, (Photo 1). Soil should be sampled at the 0 to 6 inch depth from several mapped locations per stand (Photo 2). First remove any thatch, debris or litter, place each soil sample in a clean plastic bucket and thoroughly mix the sample. In some cases, distinctly different soils may be found within a stand and these should be sampled with separate composite samples. Where uniform soils occur, there should be at least eight to ten one inch diameter soil cores to fill up a sample box or bag. Place each composite soil sample into a sample box or bag and label the sample by location. Ideally there should be at least three composite soil sample bags per 20 to 40 acre stand (Photo 2). If the soil is wet, after thoroughly mixing the composite sample and placing in labeled bags, spread the sample on paper to air dry at room temperature once back in the office. Re-bag the soil samples after 24 to 48 hours once the soil and bags have dried. Make sure to “map” where each sample was taken from in each stand (Photo 2).

Ask the lab what soil phosphorus (P) “extraction” procedure is used and how the results are reported parts per million (ppm) or as pounds per acre (lb/ac). Then compare your results with those of Table 1. If your soil sample(s) lab results are below the “critical” extractable P level (for that particular lab procedure used) then the probability of response to P fertilization is good. These P deficient sites will be mostly somewhat

poorly to very poorly drained soils of the Lower Coastal Plain ([www.forestproductivity.net/fertilization/P-fert%2012-09%20revised.pdf](http://www.forestproductivity.net/fertilization/P-fert%2012-09%20revised.pdf)) and sites that have been forested without fertilization since the 1930's or 1950's. Currently there are no soil "critical" levels for nitrogen (N), calcium (Ca), or magnesium (Mg) for loblolly, longleaf, or slash pine. Foliage nutrient determination from proper sampling and analysis ([www.bugwood.org/fertilization/foilage.html](http://www.bugwood.org/fertilization/foilage.html)) is diagnostic tool that will help determine if a stand will need N, P, K, Ca, Mg, or some of the micro-nutrients such as iron (Fe), boron (B), copper (Cu), manganese (Mn), or zinc (Zn). Leaf area index (LAI) estimates is considered the best diagnostic tool for N needs.



Photo 1. The tools required for soil sampling - clockwise from upper left of photo: a clean plastic bucket, soil bag, planter's bag (or another bucket for carrying several soil samples), soil probe with a 6" soil core, and a narrow shovel with 6" soil sample (only a small vertical slice from the shovel's soil sample will be used per sample location). Make sure each soil bag is filled to the "fill" line.



Photo 2. A 42 acre loblolly pine stand that was soil and foliage sampled (January 2010) for nutrient needs determination prior to clear-cutting and re-planting (site is N and P deficient). Note the 3 sample areas for both soil and foliage collection. An X indicates foliage sample points and a • indicates soil sample points.

**Table 1. Minimum Soil available phosphorus (P) levels for loblolly, longleaf, and slash pine stands.**

<i>Sample</i>	<i>Minimum Available P level (lbs/ac)</i>
<i>Surface soil (0-6" depth)</i>	6-10 <sup>a</sup>
	12-16 <sup>b</sup>
	8-14 <sup>c</sup>

Approximate soil P lbs/ac minimum ranges are based on the Mehlich I<sup>a</sup> (used by UGA Lab), Mehlich III<sup>b</sup>, and Bray P1<sup>c</sup> procedure. Check with your testing lab for the soil extraction procedure used. If the soil test P results are expressed in parts per million (ppm), multiply ppm by 2 to approximate lb/ac.

Acknowledgement: The authors would like to thank Dr. Pat Minogue, Assistant Professor of Silviculture – UFL for his review and comments on this paper.

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