MISSISSIPPI STATE UNIVERSITY EXTENSION

Soil pH and Tree Species Suitability in Mississippi

Suitability of the species of tree you wish to grow depends primarily on soil characteristics of your site. Among the many soil properties, pH is one of the most limiting. Soil pH provides a good indication of a soil's chemical status and can help determine potential plant growth. This publication is designed to help landowners and foresters gain a better understanding of soil pH and its effects on species-site relationships in Mississippi.

What Is Soil pH?

Soil pH is a measure of how acidic or basic a soil is. The pH scale runs from 0 to 14 and is a measure of the hydrogen ion concentration of a solution. Acidic pH values are those less than 7.0, neutral pH values are 7.0, and basic pH values are those greater than 7.0. Normally, pines and hardwoods prefer acidic to neutral soils. However, some tree species can grow well over a broad range of pH values.

Why Is Soil pH Important in Forestry?

Soil pH influences nutrient uptake and tree growth. Many nutrients change form during reactions in the soil that are largely controlled by soil pH. Trees may or may not be able to use these changed nutrients. Soils with a pH of 6.5–7.0 generally provide the best growing conditions. In this pH range, most nutrients are readily available. The vast majority of commercially important tree species can live in a broad soil pH range if the proper balance of required nutrients is maintained.

Soil pH values at the extremes (<4.0 and >8.5) can create toxic nutrients and make necessary nutrients unavailable to plants. At lower pH levels (<5.0), aluminum, iron, and manganese are readily available for plant uptake. At higher pH levels (>7.5), calcium and potassium are overabundant. In these situations, many plants will take up too many of these nutrients but not enough of others. This imbalance causes toxic conditions. Table 1 shows a range of soil pH values and nutrient availability within that range.

Table 1. Soil pH effects on soil nutrient availability.

G = greatest nutrient availability; M = moderate nutrient availability; blank spaces represent limited availability for that pH level.

Nutrient	4.0 pH	4.5 pH	5.0 pH	5.5 pH	6.0 pH	6.5 pH	7.0 pH	7.5 pH	8.0 pH	8.5 pH	9.0 pH	9.5 pH	10.0 pH
Nitrogen (N)		M	M	M	G	G	G	G	G	M	M	M	
Phosphorus (P)				M	M	G	G	G	M	M	G	G	G
Potassium (K)				G	G	G	G	G	G	G	G	G	
Calcium & Magnesium (Ca & Mg)	M	M	M	G	G	G	G	G	G	G	G	G	G
Sulfur (S)				G	G	G	G	G	G	G	G	G	G
Boron (B)		M	G	G	G	G	G	M	M	M	G	G	G
Copper & Zinc (Cu & Zn)			G	G	G	G	G	G	G				
Molybdenum (Mb)					M	G	G	G	G	G	G	G	G
Iron & Manganese (Fe & Mn)	G	G	G	G	G	G	G	M	M				
Aluminum (Al)	G	G	M										

Adapted from Plaster, E .J. (1996). *Soil Science and Management*. Third Edition. Delmar Publishers, 402 pp.

How Is Soil pH Determined?

You can determine the pH of your property's soil by two methods. The most accurate way is to collect a sample of soil and have it analyzed. You can contact your county Extension agent for guidance on soil testing. The second method of determining your property's pH involves looking in your county soil survey manual. The Natural Resources Conservation Service (NRCS) has conducted county soil surveys for many years. These surveys are available on the NRCS-maintained Web Soil Survey website. If you need assistance using or understanding the information provided, please consult your local NRCS agent or MSU Extension agent.

Fortunately, many trees grow successfully and survive over a wide range of soil pH levels. However, some species grow better at a particular soil pH level. Table 2 lists some tree species common to Mississippi and the soil pH range at which they grow best. The pH values provided below are intended to serve as a guide only. These species will often grow on soils outside the pH range listed in the table.

Summary

Soil pH is a measure of the acidity or alkalinity of soil. Levels of soil pH can be used as a general guide for determining what species will grow on a given site and are typically indicative of available nutrient levels. Use this publication as a guide to determine site suitability regarding soil pH. It only considers soil pH as a factor affecting tree survival and growth. Other soil conditions also have major influences on site suitability for various tree species. For more information on other soil conditions that can limit growth, please see MSU Extension Publication 2004 Bottomland Hardwood Management Species/Site Relationships, or contact your area Extension forestry specialist.

Table 2. Preferred soil pH ranges for Mississippi tree species.*

Common Name	Scientific Name	pH Range
Ash, Green	*Fraxinus pennsylvanica*	3.6–7.5
Baldcypress	*Taxodium distichum*	4.6–7.5
American Beech	*Fagus grandifolia*	5.0–7.5
River Birch	*Betula nigra*	4.5–6.0
Blackgum	*Nyssa sylvatica*	4.6–7.0
Cottonwood	*Populus deltoides*	3.6–7.5
Dogwood	*Cornus spp.*	5.0–8.0
Hackberry	*Celtis occidentalis*	5.0–7.5
Hickory	*Carya spp.*	4.5–7.5
Magnolia, Southern	*Magnolia grandiflora*	5.0–6.0
Maple, Red	*Acer rubrum*	4.4–7.5
Oak, Cherrybark	*Quercus pagoda*	4.5–6.2
Oak, Live	*Q. virginiana*	6.0–7.5
Oak, Northern Red	*Q. rubrum*	4.5–6.0
Oak, Nutall	*Q. texana*	3.6–6.8
Oak, Post	*Q. stellata*	5.0–7.5
Oak, Shumard	*Q. shumardii*	4.4–6.2
Oak, Southern Red	*Q. falcata*	5.0–7.0
Oak, Water	*Q. nigra*	3.6–6.3
Oak, White	*Q. alba*	4.5–6.2
Oak, Willow	*Q. phellos*	3.6–6.3
Pecan	*Carya illinoensis*	4.8–7.5
Persimmon	*Diospyros virginiana*	4.4–7.0
Pine, Loblolly	*Pinus taeda*	4.5–7.0
Pine, Longleaf	*P. palustris*	4.5–7.0
Pine, Shortleaf	*P. echinata*	4.5–7.0
Pine, Slash	*P. elliottii*	4.5–7.0
Redcedar, Eastern	*Juniperus virginiana*	6.0–7.5
Royal Paulownia	*Paulownia tomentosa*	6.0–8.0
Sweetgum	*Liquidambar styraciflua*	3.6–7.5
Sycamore	*Platanus occidentalis*	4.4–7.5
Walnut, Black	*Juglans nigra*	5.0–7.5

Adapted from Williston, H. L., & LaFayette, R. (1978). *Species Suitability and pH of Soils in Southern Forests*. USDA Forest Service.

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