Turfgrass Fertility:

Soil Texture, Organic Matter, Aeration, and pH

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Successful lawn care requires a basic understanding of soil properties. Soil is alive and dynamic. It is a complex relationship of soil minerals, organic matter, soil inhabiting organisms, and plants along with water and air (Figure 1). The mineral component, the largest, is made up of sand, silt, and clay particles. Organic matter is an important part as it contributes to moisture and nutrient retention. Containing fungi, bacteria, actinomycetes, algae, protozoa, nematodes, earthworms, and small mammals, soil is a prime habitat for biological activity. Plants use the soil to anchor themselves and as a reservoir for water and nutrients. A healthy plant starts with healthy soil.

The physical condition of a soil plays an extremely important role in turfgrass growth. Soils in good physical condition contain a balanced ratio of water, air, mineral content, and organic matter. Such soils promote deep root development, which is needed for establishing and maintaining a healthy lawn.

Too often when a lawn is graded, the topsoil is removed, leaving the clay subsoil exposed. This subsoil may contain a high amount of clay, lack organic matter, and become hardened and compacted when dry. This is common in the northern half, or Piedmont, of Georgia. It is difficult to establish and maintain a lawn under these conditions. The best means of improving this problem is by cultivating the soil thoroughly. Deeper is always better, but a minimum of 3-4 inches in depth is recommended. The addition of organic matter in such soils is also beneficial.

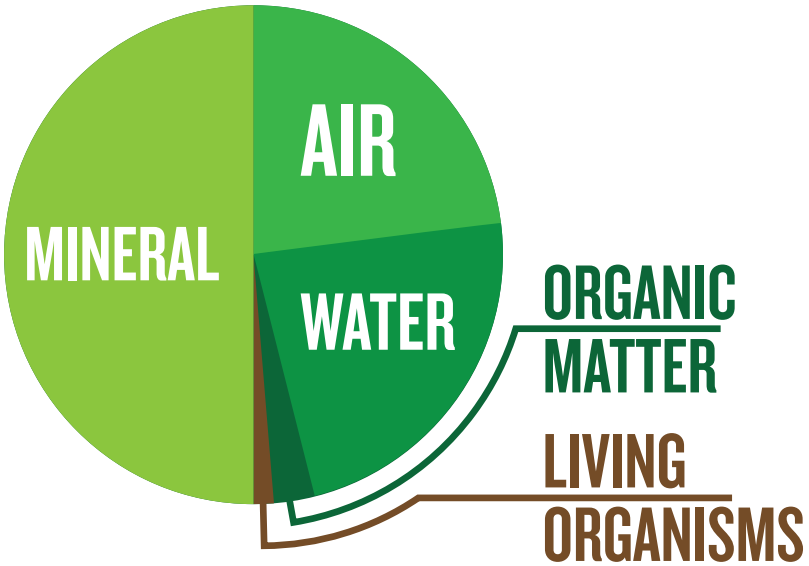

Figure 1. Composition of ideal soils.

Organic Matter

Organic materials such as compost, well-rotted (10-years-old) sawdust, decomposed leaves, grass clippings, shredded pine bark, or composted animal manure can improve a soil's physical and chemical properties and water-holding capacity. Even a relatively small addition of organic matter (from 0.3% to 3%) can improve these properties. The information in Table 1 is a guideline for application rates of some of these organic materials.

Table 1. Volume of Organic Matter to Add to Clay Soil

Material	Cubic yard per 1,000 ft²	Depth (in.) before incorporating 3-4 inches deep
Sawdust	1.5 to 3	0.5 to 1
Composted animal manure	1.5	0.5*
Composted yard trimmings	1.5 to 3	0.5 to 2*
Composted sludge	1.5 to 3	0.5 to 1

*add 2 pounds of nitrogen per 1,000 ft²

It is important to remember that for a plant to use fertilizer efficiently, it must have a well-developed root system. Poor growth of lawns is quite often due to factors other than soil fertility. No amount of soil testing and fertilizer application will overcome physical problems related to the plant root system. This includes low areas in the lawn where there is excess soil moisture or compacted areas that do not allow adequate water and air movement into the soil. Soil testing and fertilizer application also cannot overcome problems associated with excess shade, thatch, or improper management.

Aeration

Aeration, or coring, is a way to combat soil compaction. An aerator removes plugs of soil from the lawn (Figure 2). This results in improved water, nutrient, and air movement. It also stimulates decomposition of organic matter. Aeration can be done anytime the grass roots are actively growing. For warm-season grasses, soil temperatures at the 4-inch depth should be at least 65 degrees F and rising. The "average" homelawn can benefit from regular, or annual, aerification but can perform well if this practice is performed every 3 to 4 years.

Figure 2. Core aerator for home lawns.

Soil Acidity

Soil acidity is a chemical factor that can affect grass growth. Soil pH, the measure of hydrogen ion activity in a solution, is important for soil nutrient availability. The pH scale is graduated from 0 to 14. The midpoint (7) separates acid from alkaline. Any number below 7 is acidic – the lower the number, the more acidic. A soil pH above 7 denotes alkaline soil conditions. The pH scale is logarithmic; a soil with a pH of 5.0 is 10 times more acidic than one with a pH of 6.0 and 100 times more than a pH of 7.0. A soil pH that is too low or too high can decrease the amount of nutrients absorbed by plant roots (Figure 3). Lime can be used to increase the soil pH, while sulfur can be used to decrease it.

Soil pH also influences many reactions in soil, such as microbial activity. Most turfgrasses grow best in soils with a slightly acidic pH. Most soils in Georgia, however, are too acidic, and lime is often needed to maintain ideal growth conditions (Figure 4).

In the rare circumstances that the soil pH is too high (e.g. greater than 7.8) and needs to be lowered, elemental sulfur and other sulfur sources can be used. If the pH is below 7.8, ammoniacal nitrogen sources (ammonium sulfate, urea, diammonium phosphate, etc.) should be used to gradually lower the pH. Elemental sulfur should not be applied to a mature turfgrass above a rate of 5 lb/1,000 ft2. Even at that rate, foliar burn and discoloration of grass is a possibility; sulfur should be used with caution.

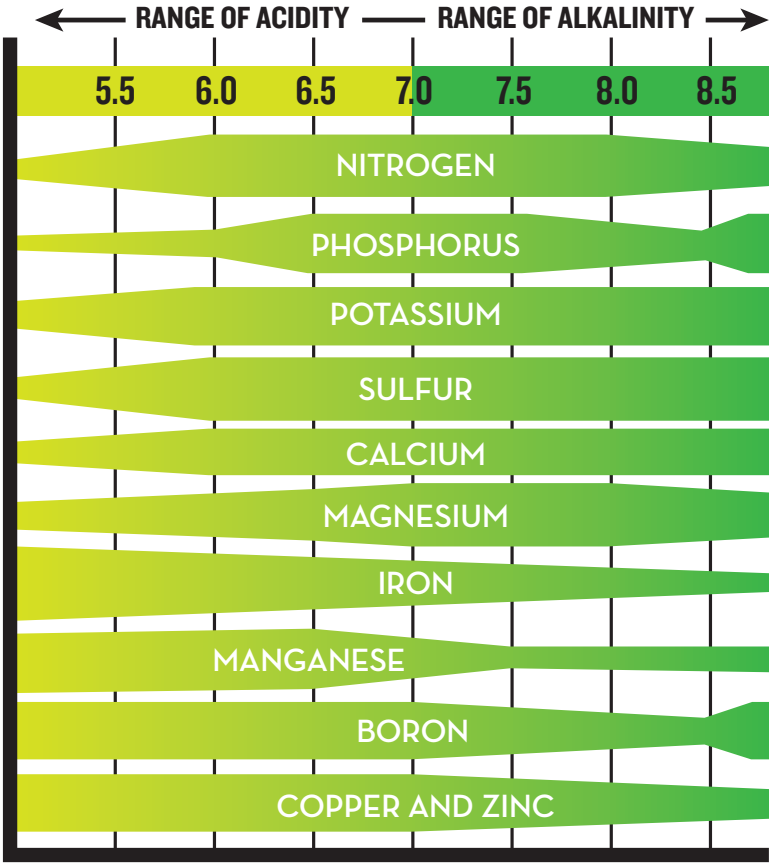

Figure 3. Nutrient availability for root absorption based on soil pH.
Source: Georgia Master Gardener Handbook, 7th ed., 2011.

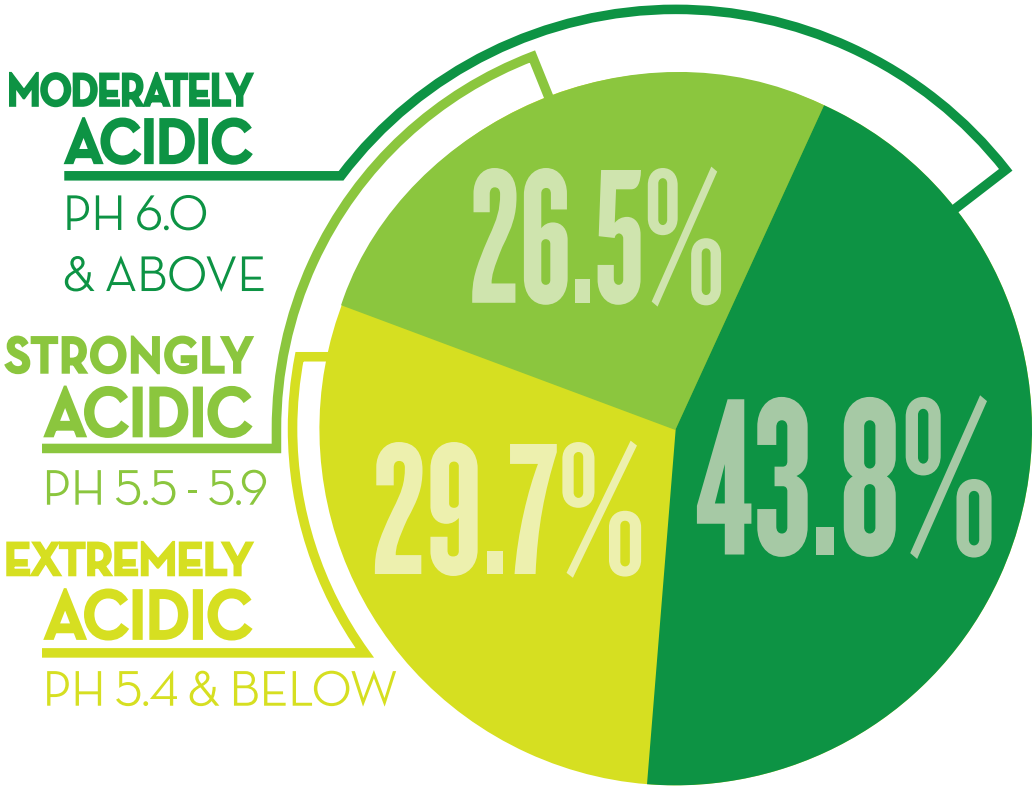

Figure 4. Acidity of soils in Georgia in 2013.
Data source: UGA Soil, Plant, and Water Analysis Laboratory.

Multiple applications at lower rates (e.g. 2 lb S/1,000) every eight to 10 weeks can help prevent injury. Furthermore, immediately following the sulfur application, irrigate with 0.3 to 0.5 inches of water to move the sulfur off the foliage and into the soil. This directs the sulfur to where it's needed and mitigates foliar burn. Consider another soil test following the second sulfur application to help determine if a third is needed.

A soil test is the best way to find your soil's lime, or sulfur, requirements. Soil testing can be done through your local UGA Extension office, or a mail-order sampling kit can be obtained online at www.SoilTest123.com. The recommendations in Tables 2 and 3 can be used in the absence of soil test information.

Table 2. Recommended Soil pH for Georgia Turfgrasses

Turfgrass	Recommended soil pH
Bermudagrass	5.5-6.5
Zoysiagrass	6.0-7.0
St. Augustinegrass	5.5-6.5
Centipedegrass	5.0-6.0
Tall Fescue	5.5-6.5
Kentucky Bluegrass	6.0-7.0

Table 3. General Lime Recommendations for Lawns

Soil type	Pounds per 1,000 ft^2
Sand	40
Sandy loam	50
Clay	70*
Clay loam	70*
Sandy clay loam	70*

*For amounts greater than 50 lb/1,000 ft^2, split the rate in half and make two applications, four months apart. For example, the clay soil recommendation would be split into two 35 lb/1,000 ft^2 applications.

***Note: Do not** apply lime to centipedegrass unless indicated by soil test results. Apply **no more** than 50 lb/1,000 ft^2 of lime in a single application.*

Summary

A healthy lawn starts with healthy soil. An understanding of soil basics can result in thriving turfgrass. Soil is alive, dynamic, and complex. The addition of organic matter, aerating to relieve soil compaction, and managing soil pH are all keys to healthy soil. For additional information contact your county Extension office at **1-800-ASK-UGA1**.

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