Soils, Water, and Fertility Handout #4:
The Meaning and Importance of Soil pH

By Richard Jauron, Iowa State University Extension, adapted by Laura Phillips

Garden soils are often described as acidic (sour) or alkaline (sweet). Unfortunately, the meanings of these terms and their relationship to plant growth are not clearly understood by some gardeners. The relative acidity or alkalinity of soil is indicated by its pH. The pH scale runs from 0 to 14. Any pH reading below 7 is acidic and any pH above 7 is alkaline. A pH of 7 indicates a neutral soil. The pH is important because it influences the availability of essential nutrients. Most horticultural crops will grow satisfactorily in soils having a pH between 6 (slightly acid) and 7.5 (slightly alkaline).

There are a few plants that require a soil pH of 4.5 to 5.5. These "acid-loving" plants include azaleas, rhododendrons, and blueberries. The soil pH for these plants can be lowered by incorporating elemental sulfur (S) into the soil. Since the soil acidifying response to elemental sulfur is slow, it should be applied and incorporated a year before planting. Working Canadian sphagnum peat into the soil is another method to lower pH.

For most plants, however, a soil pH below 6.0 is undesirable. Strongly acid soils need to be limed to raise the pH to near neutral levels. Liming materials include ground limestone which is mainly calcium carbonate ($CaCO_3$) and dolomitic limestone which contains $CaCO_3$ and some magnesium carbonate ($MgCO_3$). Since most Kansas soils do not need to be limed, apply liming materials only when recommended by a soil test.

A pH above 7.0 to 7.5 is similarly undesirable for many plants. Northeast Kansas often has high pH soils due to the abundant limestone. In this situation elemental sulfur is added to lower the pH. The amount of sulfur to add depends on how low you want the pH and on what your soil texture is. In general, to reduce the pH one point, you need the following amounts of sulfur per 100 square feet:

- Sandy soil: 1.0 to 1.5 pounds
- Loam soil: 1.5 - 2.0 pounds
- Clay soil: 2.0 - 2.5 pounds.

Elemental sulfur does not lower pH directly. It must first undergo chemical reactions with the soil before it lowers the pH. This process often takes around a year. Therefore, applying sulfur now in the fall will have the most benefit for your garden next summer. If you have perennials or existing vegetation, do not apply more than ½ pound of sulfur at a time, and wait 2 to 3 months in between applications to avoid killing the plants.

A highly visible example of the role of soil pH in the availability of nutrients can often be seen in pin oaks. Many pin oaks in the Midwest suffer from iron chlorosis which is characterized by yellowish green foliage. The yellowing of the leaves is caused by a deficiency of iron within the plant. Most Kansas soils contain sufficient quantities of iron for good plant growth and leaf coloration. Unfortunately, much of the iron is in an insoluble form and is unavailable to pin oaks when the soil pH is above 7.0. Iron is readily available to pin oaks at a pH range of 5 to 6.5. Since efforts to correct iron chlorosis are extremely difficult, gardeners should avoid planting pin oaks in alkaline soils.

Taken from:

Jauron, Richard. "The Meaning and Importance of Soil Ph." *Yard and Garden*, 19 Mar. 2024, yardandgarden.extension.iastate.edu/article/2002/5-24-2002/soilph.html.

Soil pH continued….

The excerpt from Richard Jauron at Iowa State does a great job explaining the basics of soil pH. Jauron mentions that soil pH alters nutrient availability. This is because a high pH soil tends to have a negative charge. A low pH soil tends to have a positive charge. Many nutrients have a charge.

Things that are positively charged want to bind with negatively charged things. So a high pH soil will bind with positively charged nutrients, making them inaccessible to plants. Similarly, a low pH soil will bind with negatively charged nutrients, making them inaccessible to plants. Below is a graph from the KRSE EMG handbook that shows how nutrients change in availability based on soil pH.

