About Soil pH

Rhododendron
University of Minnesota Extension

To gardeners who want to grow the prettiest flowers, nicest shrubs, and delicious food items, soil pH is an important and often overlooked item. Plants such as blueberries, rhododendrons, and pin oaks do well in and need acidic soil to thrive and survive. Plants such as grapes, clematis, lilacs, peonies, salvia, and sage will do well in alkaline soils. With big leaved hydrangeas (*Hydrangea macrophylla*) such as 'Endless Summer', the color of the blossoms will actually change from pink in alkaline soil, to purple at neutral soils, and to a beautiful blue in acidic soils. Aluminum sulfate is added to soils around these hydrangeas to create an acid environment and provide Aluminum for a blue color.

PH is an indication of the acidity ("sourness") or alkalinity ("sweetness") of the soil. Soil pH is measured on a scale from 0 to 14, with pH 7 as the neutral point. A pH going from 7 to 0 becomes increasingly acid. A pH going from 7 to 14 becomes increasingly alkaline. PH itself is a chemical measurement, the negative logarithm of the hydrogen ion concentration. The pH scale is logarithmic; a soil with a pH of 6.0 is 10 times more acidic than a soil with a pH of 7.0; a soil with a pH of 5.0 is 100 times more acidic than a soil with a pH of 7.0.

From the SUNY College of Environmental Science and Forestry...

Descriptive terms commonly associated with certain ranges in soil pH are:

- **Extremely acid:** < than 4.5; lemon=2.5; vinegar=3.0; stomach acid=2.0; soda=2–4
- **Very strongly acid:** 4.5–5.0; beer=4.5–5.0; tomatoes=4.5
- **Strongly acid:** 5.1–5.5; carrots=5.0; asparagus=5.5; boric acid=5.2; cabbage=5.3
- **Moderately acid:** 5.6–6.0; potatoes=5.6
- **Slightly acid:** 6.1–6.5; salmon=6.2; cow's milk=6.5
- **Neutral:** 6.6–7.3; saliva=6.6–7.3; blood=7.3; shrimp=7.0
- **Slightly alkaline:** 7.4–7.8; eggs=7.6–7.8
- **Moderately alkaline:** 7.9–8.4; sea water=8.2; sodium bicarbonate=8.4
- **Strongly alkaline:** 8.5–9.0; borax=9.0
- **Very strongly alkaline:** > than 9.1; milk of magnesia=10.5, ammonia=11.1; horticultural lime=12

Soil pH is easily determined by an electronic test meter. Alternatively, home pH test kits depend on a color change of dyes or special papers. These kits will give you a ballpark indication of your pH, and may be purchased on-line or at local garden enters. On the whole, the kits are not as accurate or reliable as meters, especially in alkaline soils. A complete soil test, including pH, can be obtained for $17.00 from the University of Minnesota soil laboratory. Complete instructions can be found at http://soiltest.cfans.umn.edu/.

Most of the local soils in the Twin Cities are neutral to alkaline in reaction (about pH 7.0 to 8.2). The bedrock under our soils is limestone (calcium), and as it breaks down, an alkaline or neutral soil results. Our soils do not need additional lime; we have plenty of it in our soil. Adding lime will actually cause our soils to become even more alkaline and may become toxic to plant growth. Likewise, using wood ashes on our local gardens is not advised; wood ashes are highly alkaline. High soil pH (very high alkalinity) can lead to decreased availability of important micronutrients such as iron and manganese to plants. A condition called chlorosis can result. Newer leaves at the branch tips will turn yellow. The leaf veins remain green, while the rest of the leaf tissue turns yellow or pale green. (See Iron and manganese deficiencies in woody plants, http://www.extension.umn.edu/garden/yard-garden/trees-shrubs/iron-chlorosis/). Cement and cement trash (often buried in your yard by your building contractors) can cause drastically increased alkalinity, and result in chlorotic leaves and decreased plant vigor.

At our alkaline pH, it is difficult to grow acid-loving blueberries or rhododendrons without amending the soil. Pine needles are not the solution to making soil acidic. Pine trees grow well in acidic soils; pine trees do not cause the soils to become acidic. Pine needles will decompose to about a neutral reaction and will not do much to change the soil to an acid reaction. However, pine needles do create an excellent mulch for plants and upon decomposing, add useful humus to the soil structure. When planting acid-loving plants, acidic sphagnum peat moss is generally added (50/50 with native soil) to the planting hole.

Permanent acidification of our soils is a long term and ongoing process. To maintain optimum soil acidity over the long run, soil sulfur or garden sulfur may be purchased from local garden centers. Quantities needed will vary according to the structure/heaviness of the soil. Follow the package directions and retest the soil a year later. Sulfur is a slow reacting acidifier; it will take up to a year for soil bacteria to process the sulfur and add acidic compounds to the soil. Ideally, the sulfur should be mixed into the top six inches of soil. Aluminum sulfate is rapid acting and does lower soil pH, but there is a risk of adding too much aluminum in the process and making the soil toxic. When fertilizing acid-loving plants, use an acid-based solution such as azalea or rhododendron fertilizer. Urea and ammonium nitrogen fertilizers are acidic. In the long run, it may be more practical to choose plants suitable for your pH conditions than to try to change pH; for example, grow Juneberries in alkaline soils rather than trying to grow blueberries.

Happy Gardening,
Joe Baltrukonis