K-12 Activity

Soil Science Society of America

Soil pH

What is pH?

pH is the measurement of the acidity or alkalinity. Everything around us has a pH and this test can be done on a variety of things such as food (e.g. ketchup, orange juice, etc.), household products (e.g. bleach), medical samples (e.g. urine), and environmental samples (e.g. water, soil, etc.). In chemistry terms, pH is the negative logarithm of hydrogen ion (H+) activity. In all cases, it is measured on a scale of 0 to 14 of which 7 is considered to be neutral. If it falls below 7 it is acidic and if it is above 7 it is alkaline or basic.

Why is it important in soil?

For soil health! In the soil, availability of plant nutrients such as nitrogen (for foliage), phosphorus (for root formation and energy transfer), and potassium (for seed formation/germination and sugar formation) are affected by the pH of the soil. Soil pH is not a nutrient but does tell us how well plants can pull nutrients from the soil. And microorganisms live in the soil and their activity is affected by soil pH around them. These organisms are responsible for decomposition of leaves and other plant tissues, dead animals, and for biodegrading of organic compounds in soil. Soil pH also affects the dissolution of soil minerals that are then released as nutrients for growing plants.

What does the pH test mean?

Different crops and plants (including grass) generally have an optimum pH where they thrive. Some do well in acidic soil (e.g. azalea, blue-flowered hydrangea and potatoes), some between acidic and neutral soil pH (e.g. beans, carrots and corn), and others in the alkaline pH (e.g. alfalfa and sweet clover). For home gardens, a general range is 6-7, depending on what is planted.

When the soil pH is below the ideal, it can be raised by the addition of lime. The quantity of limestone ($CaCO_3$) required to raise the pH of an acid soil to a desired pH level is referred to as lime requirement. When the soil pH is high, application of ammonium fertilizers, urea, sulfur/ferrous sulfate, and using acidifying residues (e.g. pine needles, saw dust and acid moss) can help to reduce soil pH. The addition of organic matter (plants and compost) can make soils more resistant to a drop or rise in pH.

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How to Measure Soil pH with Paper Test Strips

1. Collect a sample

Using a hand trowel, scoop some soil from 0 to 3-inch depth from different spots in the yard.

Mix thoroughly and spread out the soil sample to air dry.

Remove rocks, stones, roots and leaves as much as possible.

2. Prepare sample

Prepare a 1:1 ratio (volume basis) of soil and water.

Scoop ⅛-cup (30 mL) of dry soil into a cup with lid or specimen bottle with cap.

Add ⅛-cup (30 mL) of distilled water to the soil.

Put the lid/cap on the container and shake vigorously about 25 times.

Allow the soil-water mixture to settle for 10 to 15 minutes.

(Measure the soil pH as described in Step 3).

3. Measure pH

Insert a small portion of the pH paper in the liquid above the soil and allow the liquid to move up into the paper. Remove and let the color develop for 60 seconds.

Read the paper color using the pH color chart.

Suitable Soil Test Ranges	
Apples	5.6-7.0
Azalea	4.5-5.7
Beans, lima	5.5-6.7
Beans, snap	5.5-6.5
Carrots	5.6-7.0
Corn	5.5-7.0
Cucumber	5.5-6.7
Hydrangea (blue)	4.5-5.5
Hydrangea (pink)	>6.5
Kale	5.25-7.0
Lettuce	6.0-7.0
Onions	6.0-6.25
Peas	6.0-7.0
Peppers	5.5-6.5
Potatoes	5.0-5.4
Spinach	6.0-7.0
Squash	5.5-6.5
Strawberries	5.0-6.5
Tomatoes	5.5-6.75

*Adapted from USDA-NRCS Soil Quality Test Kit Guide: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050956.pdf