How to Test Soil pH

Cornell Cooperative Extension SOIL3 Project

By Runlong Dong

Soil pH affects nutrient availability, plant toxicity and even your crop yield. To ensure that pH is in the ideal range for your plants (around 6.2-7.2 for most crops), test your soil before planting. This bulletin provides a step-by-step guide for home methods to measure soil pH or sending samples to a lab. See Appendix A for resources about soil sampling and optimal crop pH.

Collecting Soil Sample

1. Prepare for sampling

Whether you plan to test at home or at a lab, it's important to collect soil that represents the area(s) of interest. If you are submitting to a lab, check to see if they have any specific instructions. Try to sample when the soil is dry to moist (not too saturated). Make sure you have a comfortable and sturdy digging tool (like a trowel) as well as a bucket for your samples. When monitoring pH over time, sample the soil around the same time of year as the previous measurement. For most crops, sampling every 2-3 years is best.

2. Sample at the proper depth

Dig a hole to the needed sampling depth (generally the top 6" for garden soils). Cut a ½" slice from the face of the hole and trim the sides to get a vertical slice of soil of uniform width and thickness. You can also use a soil probe or auger to collect a plug of soil to the desired depth. Repeat for as many samples as needed to represent the area(s) of interest. Large fields may require 10-20 samples, while small garden beds may only need 4 or 5. Add each sample to your bucket. Repeat for any other soil areas that you'd like to test, keeping the samples from each area separate.

3. Mix the samples together

Thoroughly mix the samples in the plastic bucket to get a representative composite. Remember to create a separate composite for each area of interest. Remove large rocks or organic material. If the soil is too wet for good mixing, spread it out on a sheet of newspaper and dry it at room temperature.



A person using a soil auger
Source: SAGT, 2010, Flickr (https://www.flickr.com/photos/46860625@N07/4972437928). CC BY 2.0.

4. Taking the sample for analysis

Take some of each composite soil mix for analysis. While most labs require a volume of about 2 cups, home methods may need less. Return extra soil to your sampling area(s).

5. Send your sample to a lab, or prepare for testing at home

If testing at home, collect the needed supplies and equipment. If you are sending the samples to a lab, package and ship the soil according to the lab's instructions.

Testing pH at Home

A wide range of do-it-yourself soil pH tests can be used at home. These include vinegar and baking soda, homemade red cabbage juice, and commercial kits like pH papers or pH meters. Vinegar and baking soda will provide a general sense of the soil pH. Add a tablespoon of your soil sample to a container and drip some vinegar on it. If bubbles form, the soil is alkaline (pH > 7). If no bubbles form, place another tablespoon of soil in a second container. Add some water to make a thick slurry, then add baking soda. If bubbles form, the soil is acidic (pH < 7). If no bubbles form in either cup, the soil is generally neutral (pH around 7).

Red cabbage juice is an inexpensive pH indicator that will give you a more precise soil pH. Add four cups of water to two fresh red cabbage leaves in a blender and process until smooth. It's important to use red cabbage leaves as green cabbage won't work. Pour the cabbage juice through a funnel with filter paper (such as a coffee filter) to remove any solids. Add a tablespoon of soil to a small jar with enough cabbage liquid to submerge the sample and shake. The cabbage juice will change color depending on the soil pH. Reds through pinks to purples show ranges of acidity, while blues to greens show increasing alkalinity. Color codes are easily found online.

Store-bought products can be an easier but expensive alternative. Options include pH paper, liquid reagents, or powders. If available, a pH meter can measure pH most accurately. Appendix B has more resources about performing each pH test method.

Choosing a Soil Testing Lab

If you prefer to send your samples to a lab, make sure that you check with the lab about their services, costs, recommended sampling procedures, and the timeline for receiving results. Appendix C provides a list of analytical labs in NY state.

Understanding Your Results

Labs usually send interpretation materials along with your pH test results. Depending on the lab and the service you chose the reports can look different. But whether your soil was tested at home or a lab, here is some basic information:

Soil pH measures soil acidity, which affects the availability of soil nutrient to plants. For most crops the ideal pH for nutrient availability is around 6.2-7.2 (potatoes and blueberries prefer more acidic soil). Generally, a high pH can result in deficiencies of phosphorus, iron, manganese, copper, or boron. A low pH can result in deficiencies of calcium, magnesium, phosphorus, potassium, or molybdenum. Very low pH can result in plant aluminum toxicity. If your soil pH is low, raise the pH with lime, wood ash, or organic matter. High soil pH is common in drier regions. Sulfate products can lower the pH if needed. See Appendix A for additional resources about crop pH requirements and how to manage your soil pH.

Appendix A - Resources for Soil Sampling and Optimal Crop pH

- Soil sampling method from Cornell Cooperative Extension of Tompkins County

http://ccetompkins.org/gardening/home-gardening/soils-climate/how-to-take-a-soil-sample.

- Soil sampling protocol with an instructional video from Cornell Soil Health Laboratory

https://soilhealth.cals.cornell.edu/testing-services/collecting-samples/

- Optimal pH in various crops

http://nmsp.cals.cornell.edu/publications/files/VegetableGuidelines2019.pdf (Page 10-11).

Appendix B - Resources for Using Various pH Tests

- Video instructions and suggestions for using pH meter

https://www.youtube.com/watch?v=mZgxUqoJMcg

- Video instructions for using pH paper

https://www.youtube.com/watch?v=PiCO9gsjLMQ&t=334s

- Video instructions for using vinegar and soda

https://www.youtube.com/watch?v=_KX8yVj5PHI

https://mylespower.co.uk/2012/04/06/homemade-ph-indicator/

- Video instructions for making and using cabbage juice, and an image of colors at different pH levels

https://www.youtube.com/watch?v=I18K2upEHLc

- Video instructions for using a pH testing powder

https://www.youtube.com/watch?v=_fEK55r4W8o

- Video instructions for using a liquid pH indicator

https://www.youtube.com/watch?v=-WyIppZ-uoQ

- Video instructions for using Cornell soil's pH test kits

https://www.youtube.com/watch?v=PiCO9gsjLMQ&t=334s

Appendix C - Soil Analytical Labs in NY

1. Cornell Soil Health Laboratory

Address: Soil Health Lab G01 Bradfield Hall 306 Tower Rd. Ithaca, NY 14853

Contact Information: soilhealth@cornell.edu; 607-227-6055

Website: https://soilhealth.cals.cornell.edu/testing-services/individual-soil-analyses/

Soil sampling protocol: Page 28 - 29 (http://www.css.cornell.edu/extension/soil-health/manual.pdf)

Services: The Cornell Soil Health Lab offers three types of soil health analysis packages

Example of results report: http://www.css.cornell.edu/extension/soil-health/manual.pdf (page 110-120)

2. Cornell Cooperative Extension of Tompkins County

Address: Tompkins Education Center 615 Willow Avenue. Ithaca, NY 14850-3555

Contact Information: tompkins@cornell.edu; 607- 272 -2292

Website: http://ccetompkins.org

Soil sampling protocol: http://ccetompkins.org/gardening/home-gardening/soils-climate/how-to-take-a-soil-sample

Services: pH testing; Standard nutrient test

Appendix C (Continued)

3. Cornell Cooperative Extension of Cortland County
Address: CCE-Cortland 60 Central Avenue, Room 140. Cortland, New York 1304
Contact Information: cortland@cornell.edu; 607-391-2660
Website: http://cortland.cce.cornell.edu/gardening/soils-climate/soil-testing-services
Soil sampling protocol: http://cortland.cce.cornell.edu/gardening/soils-climate/how-to-take-a-soil-sample
Services: pH testing; Standard nutrient test

4. Dairy One
Address: 730 Warren Rd. Ithaca NY 14850
Contact Information: soil@dairyone.com; 800-344-2697
Website: https://dairyone.com
Soil sampling protocol: https://dairyone.com/services/agronomy-services/soil-analysis/taking-a-sample/ (Click on "Taking a soil sample" link on this webpage for more information)
Services: https://dairyone.com/services/agronomy-services/soil-analysis/packages/
Example of results report: https://dairyone.com/download/understanding-your-soil-results/?wpdmdl=16104&refresh=6 08090feeef4b1619038462

5. Turf & Soil Diagnostics
Address: 35 King Street. Trumansburg, NY 14886
Contact Information: lab@turfdiag.com; 855-769-4231
Website: http://www.turfdiag.com
Soil sampling protocol: http://www.turfdiag.com/library/ (Click on "Sampling Guidelines" link on this webpage for more information)
Services: http://www.turfdiag.com/soil-test-descriptions/

6. TestAmerica (Syracuse) Service Center
Address: 118 Boss Rd, Syracuse, NY 13211
Contact Information: 315-431-0171
Website: https://www.testamericainc.com
Services: https://www.testamericainc.com/services-we-offer/services-we-offer-by-sample-matrix/soil/