How Soil pH Affects Essential Plant Nutrients

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If you were limited to measuring just one soil parameter, it should be the pH of the soil. Soil pH is an indicator of soil acidity or alkalinity. A pH of 7 is neutral. Values below 7 are considered acidic while those above, alkaline. Soil pH measures the amount of hydrogen ions in the soil water, often referred to as the soil solution. The more hydrogen ions in the soil solution, the lower the soil pH, and the more acidic the soil. So, as the soil pH decreases, the hydrogen ion concentration increases exponentially and that means more limestone will be needed to increase soil pH to the desired level for the plants you are growing. It is important to occasionally measure the pH of your soil to make sure it does not drop too low.

In many areas of Connecticut, our soils are naturally acidic with a pH of between 4.0 and 5.5 or so. Many of our fruits, vegetables, turf grasses and ornamentals do best when the pH is around 6.5. Limestone is commonly added to our soils to raise the pH. Without regular limestone additions, our soils tend to become more acidic due both to natural processes as well as the use of ammonium containing chemical fertilizers, such as those containing urea.

One reason why soil pH is so important is that it affects the availability of all plant nutrients. This is because the pH of the soil determines the extent to which the nutrients are soluble in the soil water. Plants take up these nutrients that are dissolved in the soil water as they take up water through their roots. In general, many of the nutrients that our plants need are most available when the soil pH is between 6 and 7. If the soil pH is on the low side, especially in sandy soils or those containing small amounts of organic matter, nutrient deficiencies can occur. Typically soils with a low pH are deficient in calcium and magnesium. These two nutrients are added to the soil with limestone applications. When the soil pH is too low, phosphorus deficiencies can occur. Low pH also reduces capacity of nitrogen fixation by legume plants.

Soil pH is highly correlated with solubility of soil aluminum. When the soil pH is less than 5.5, aluminum becomes soluble and aluminum ions show up in soil solution. As soil pH decreases further, the amount of soluble aluminum increases dramatically. Aluminum is not a plant nutrient and is toxic to plants. High aluminum content may reduce crop productivity by inhibiting root growth and in turn, reduce the amount of water and nutrients plants take up. Our cool season turfgrasses are especially susceptible to aluminum toxicity and low pH is a main reason that many lawns struggle. High aluminum content may also increase the chance of some diseases and

contribute to herbicide resistance. In addition, high aluminum contents in soil can bind with phosphorus and reduce its availability to plants.

Although the optimum soil pH for both plant growth and soil fertility is between 6 to 7, many plants can tolerate a soil pH as low as 5.5. Some like rhododendrons, azaleas, blueberries and others in related families prefer the soil pH to be 5.5 of lower.

Soil amendments, such as calcitic or dolomitic limestones, can be used to increase soil pH. Applying the right amount of limestone is key to increasing the soil pH to the target level for a particular plant while avoid over liming. Wood ashes and compost can also raise the soil pH.

The easiest way to determine if limestone is necessary and how much to apply is by submitting a soil sample to the UConn Soil Nutrient Analysis Lab (www.soiltest.uconn.edu). Whenever collecting a soil sample, be sure to take a representative one. This is done by taking several subsamples from the top to about 6 inches down, placing these subsamples in a clean container, mixing them up and then scooping up a cup of soil. This would give you a more representative sample than if you just collected soil from one spot.

There are some home pH testing kits and they vary in their accuracy. One might try collecting a sample, mixing it thoroughly and dividing in half. Send half to a lab and test the other half yourself to see if the results are comparable.

Soil pH is important to monitor for healthy plant growth. It is easy to measure and limestone is fairly inexpensive to purchase. See that your plants are off to a good start this year by checking the pH of your soils.

For questions on soil testing or if you have any other gardening questions, contact the UConn Home & Garden Education at (877) 486-6271 or www.ladybug,uconn.edu or your local Cooperative Extension Center.