SWEET SOIL HEALTHY CROPS

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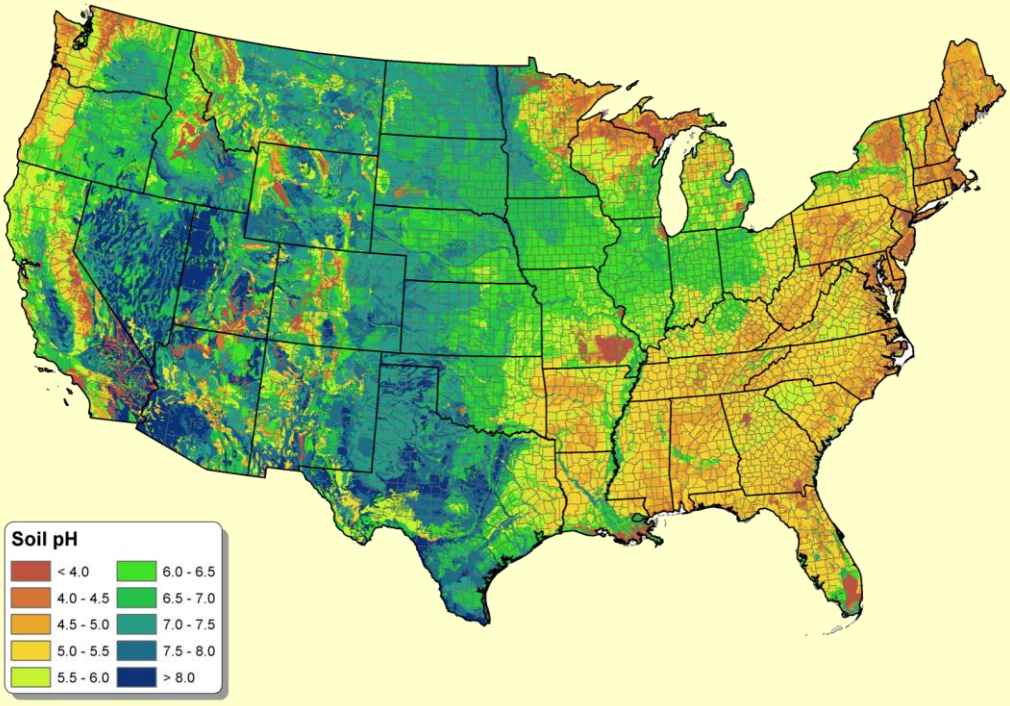
The foundation of healthy crops is healthy soil. Some have used the phrase “sweet soil” to describe soils which are neutral to alkaline rather than acidic in nature. In fact, some farmers used to determine soil productivity by putting balls of soil in their mouths and tasting how “sweet or sour” it was. Soil pH is a measure of acidity and alkalinity on a scale of 1-14, with 7 being neutral. Most soils fall in a pH range of 4 to 9. Many crops need “sweet soils” to grow vigorously, and alfalfa is chief among them. Being successful with alfalfa starts by knowing your soil pH and adjusting or “sweetening” it so plants and nitrogen-fixing bacteria can be healthy and achieve high forage yields.

North American soils have a wide range of pH levels. Variability in natural soil pH is the result of big-scale factors including climate, soil parent material and mineral content, topography, and soil microorganism activity. Over time, climatic factors like temperature and rainfall continue to influence soil acidity due to weathering and leaching.

“Scientists have known that climate influences soil chemistry, and in particular, soil pH. In dry climates, soil is alkaline; in wet climates, it’s acidic,” states researcher Eric Slessarev in a 2016 article (Nature 540, 567–569). He further points out that the transition between those two zones is very abrupt. It only takes a small change in climate to achieve the switch from an acid zone to an alkaline zone, and there are fewer soils with an intermediate pH. In more humid environments, soil pH decreases over time through soil acidification. In dry climates, soils are more neutral and alkaline and stay that way since there is not sufficient soil weathering and leaching activity. Soils high in organic matter or with a high clay content are more able to buffer changes in pH than sandy soils. Finally, use of commercial fertilizers in crop production – especially nitrogen fertilizer – can also make soil more acidic.

Farmers can improve productivity of acidic soils through liming to adjust the soil pH to what is best for the crop to be grown. Benefits of liming include increased nutrient availability, improved soil structure, and increased rates of infiltration. In addition, liming helps with the uptake of desired micronutrients while reducing the possibility of excess uptake of toxic minerals. Lime encourages improved microorganism activity, including the N-fixing bacteria so critical to alfalfa growth. Since alfalfa is a pH-sensitive crop, paying attention to soil pH and liming is key to producing high forage tonnage and quality.

Soil pH map of the U.S (Forage Information System, Oregon State University)



The first step in adjusting soil pH starts with a good soil test. Ideally, this is done using grid-mapping so you can lime only spots where pH is lowest and avoid paying for lime where it is not needed. While a soil pH measurement can tell us where the acidic areas are in a field, it doesn’t tell us how much lime it will take to change soil pH. Soil analysis labs determine the proper quantity of lime to apply to reach a certain pH target based on soil type. Some soil types require more lime to change pH, since they are more highly buffered. Two factors influence the neutralizing value of agricultural lime – the chemical neutralizing value of the lime material relative to pure calcium carbonate ($CaCO^3$), and the fineness or particle size of the ground lime. Finely ground lime has a greater surface area than a coarse grind and will react faster to neutralize soil acidity.

Liming materials usually contain calcium (Ca) and magnesium (Mg) in various ratios. The neutralizing value of liming materials – referred to as the $CaCO^3$ equivalent – is related to the amount of acid that a given weight of lime will neutralize. The standard for evaluating materials is pure $CaCO^3$, which is given a value of 100%. The purity of a liming material is assumed to be 100%, so if impurities exist, liming rate may also be adjusted to account for this difference.

Forages and livestock are found in both wet and dry climates and in areas with acidic and alkaline soils. Soil pH – and thus soil fertility and plant health – are tightly linked to climatic conditions and soil-weathering factors. In many areas, forage crops are grown on the edge of suitable soil pH, and small changes in cropping systems or weather can have large impacts on farm productivity. While liming soils may not make it on the top ten list of most important things in life, the practice is worth paying special attention to because soil pH is critical for forage success on the farm.