Acidifying Your Soil

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Soil pH
Plants have a preferred soil pH range where their roots are able to take up the nutrients needed for their growth. A soil pH out of this range will reduce plant growth; and can cause certain nutrients to become toxic, or may become so insoluble as to lead to die back and potentially death to the plant.

The soil pH in our area varies from site to site. It is important to determine your soil pH for proper plant selection and management. A soil test from K-State Research & Extension will provide you with this information.

pH (hydrogen verses hydroxyl ions) scale ranges from 0 to 14 with 7 being neutral. Soil pH values below 7 indicate acidic (sour soil or one with more hydrogen ions than hydroxyl ions). Values above 7 indicate basic soils (referred to as alkaline, sweet or has more hydroxyl ions than hydrogen ions).

A pH of 6.0 to 7.2 is conducive for proper growth of most garden and landscape plants. However, soil pH in the range of 7 to 8 is adequate for many plants. ***Living with and selecting plants that tolerate a slightly alkaline soil (pH 7.0 to 8.0) is much easier and less expensive than trying to lower soil pH***.

Why Do I Have an Alkaline Soil?
There are a couple of factors contributing to having a high pH. Our soils come from the chemical breakdown of rock referred to as parent material. The most common parent material around Riley County is limestone. Limestone ($CaCO_3$) will neutralize acid and increase the soil pH. Natural rainfall can remove some hydroxyl ions and leach basic cations (such as Ca, Mg, and K) past the root zone. It takes lots of natural rainfall to accomplish this (40-45 inches yearly average over centuries). Our average rainfall of 34 inches is not sufficient to remove great quantities of the hydroxyl ion or cations to create an acid soil. We do get sufficient rainfall to remove some hydroxyl ions into our ground water. This ground water is often what we use to irrigate our landscape when it is dry. This addition of water also adds hydroxyl ions which keeps our soil pH alkaline.

If you use Manhattan water, its pH has been measured at 8.51. Well water would likely have similar results.

Wood Ashes?
Wood ashes are very alkaline, and since they have a very fine particle size, they act as a fast-acting liming material. Lime and ashes raise the pH of the soil, so use wood ashes in moderation to avoid those high pH levels. Microorganisms are unable to break down organic matter in high alkaline soils. Some plants find it difficult to take up nutrients when the soil has a higher pH. These are all reasons not to spread ashes heavily in one spot. Care must be taken not to put ashes where acid loving plants are located, or where you plan to grow plants that like soil on the acid side, like potatoes, blueberries and azaleas. In most of our soils the addition of wood ashes would be detrimental and should never be done with out a soil test that indicates acid soils.

Temporary Solution
Foliar feeding to compensate for the wrong pH is a band-aid approach to producing healthy plants. Leaves are not designed to take in nutrients. When it does absorb enough nutrients it is short lived. Many micronutrient product labels recommend every other week applications. This is a good marketing tool to keep you purchasing their product.

What To Do?
High pH soil may be acidified by adding elemental sulfur. Granular elemental sulfur is the safest, least expensive but slowest acting product. Sulfur is transformed by soil bacteria to sulfuric acid which will neutralize soil alkalinity. The pH change is gradual over time. It can take up to a year to record a change in the soil pH. Check pH at the same time each year, as soil pH varies seasonally.
Due to the total amount of hydroxl ions present in alkaline soils, this is a never ending battle. As soon as the sulfur is "used up" pH will begin to return to original levels. Sulfur is useful for reversing the effects of high pH irrigation water or for changing soil pH in a small area.

Aluminum sulfate and iron sulfate react quicker than elemental sulfur. However, they must be applied at a 5 to 6 times greater rate (Table 1) than sulfur. Do not apply more

than 5 lbs per 100 square feet at any one time. Excessive amounts of these two sulfates can also injure plants.

Amount of Sulfur (95%S) needed to lower the pH
Table 1

pH change	Sandy soil	Loamy soil	Clayey soil
7.5 to 6.5	1-1.5 lbs.	1.5-2 lbs.	2-2.5 lbs.
8.0 to 6.5	2.5-3 lbs.	3-4 lbs.	4-5 lbs.
8.5 to 6.5	4-5 lbs.	5-6 lbs.	6-7 lbs.

Weights are in Pounds per 100 Square Feet.

Soil pH found by (6-inch depth) measurement. ***Broadcast sulfur to the intended areas, diameter of your plants roots. Till in to 6-inch depth.***

Soil Factors
The soil texture and organic matter content impact the amount of sulfur needed to change the pH. The more clay and organic matter in the soil, the more sulfur it will take to lower the soil pH. This is sometimes referred to as the soils "buffering" ability. Sandy soils require less sulfur.
Note: It would be beneficial to know these amounts to make the best recommendation on the amount of sulfur it will require. The K-State Research & Extension soils lab can determine the texture and amount of organic matter.

Preferred pH for other horticulture plants are available on the internet. Here are a couple of good sites that were active at the time of printing.

Landscape plants
https://extension.msstate.edu/sites/default/files/publications/publications/p2571_0.pdf
Vegetable & Fruits
http://www.bookstore.ksre.ksu.edu/pubs/mf2320.pdf

Turf or Lawn areas
Use Table 1 recommendations of sulfur when starting a new lawn and the soil is tilled to a depth of 6 inches. Sulfur applications to established lawns should be applied in conjunction with core aeration. For established lawns, do not apply more than 5 pounds/1,000 square feet at one time. Continue to core aerate and apply 5 pounds/1,000 square feet each spring and fall until the soil pH has reached your desired level. Table 1 is a guide to the total amount of sulfur it will require.
Do not apply sulfur to established turfgrass if the air temperature is 80 degrees Fahrenheit or higher, because of the risk of burning the turf.

pHs for Turfgrasses

Turf	Tolerance Range	Preferred
Bermudagrass	**5.5-7.5**	**6.0-7.0**
Buffalograss	**6.0-8.0**	**6.0-7.0**
Zoysiagrass	**5.0-7.8**	**6.0-6.5**
Kentucky bluegrass	**6.0-7.2**	**6.0-7.0**
Tall fescuegrass	**4.7-8.5**	**5.5-6.5**

Other Options
Addition of organic matter and use of organic mulches can also help acidify soils and lower pH levels. Peat and sphagnum peat moss are highly acidic and will lower soil pH more than other organic amendments.

When selecting a nitrogen fertilizer source, consider using acidifying fertilizers such as ammonium sulfate and other products with label designations indicating an acidic reaction in the soil. With repeated use these materials may reduce soil pH.

Acidifying Nitrogen Fertilizers

Ammonium sulfate	21% N & 24% sulfur
Urea	46% N & 12% acidity
Ammonium phosphate	15% N & 10% acidity

Soil bacteria change the ammonium form of nitrogen from these products to the nitrate form. A by-product of the process is hydrogen ions, which acidify soil. Acidifying fertilizers decrease soil pH more gradually than elemental sulfur. More than 2 years could be needed to decrease soil pH by 0.4 pH unit using a nitrogen fertilizer.

Bottom Line
Because of the nature of our soils, your soil is most likely alkaline. Periodic testing and most likely additional sulfur will be required over time. You need to decide if this is a soil management practice you will desire to carry out over the long run or learn to live within the bounds of our native soils properties.

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