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Changing the pH of Your Soil

The soil pH value is a measure of soil acidity or alkalinity. Soil pH directly affects nutrient availability. The pH scale ranges from 0 to 14, with 7 as neutral. Numbers less than 7 indicate acidity while numbers greater than 7 indicate alkalinity.

The pH value of soil is one of a number of environmental conditions that affects the quality of plant growth. The soil pH value directly affects nutrient availability. Plants thrive best in different soil pH ranges. Azaleas, rhododendrons, blueberries and conifers thrive best in acid soils (pH 5.0 to 5.5). Vegetables, grasses and most ornamentals do best in slightly acidic soils (pH 5.8 to 6.5). Soil pH values above or below these ranges may result in less vigorous growth and nutrient deficiencies.

Nutrients for healthy plant growth are divided into three categories: primary, secondary and micronutrients. Nitrogen (N), phosphorus (P) and potassium (K) are primary nutrients which are needed in fairly large quantities compared to the other plant nutrients. Calcium (Ca), magnesium (Mg) and sulfur (S) are secondary nutrients which are required by the plant in lesser quantities but are no less essential for good plant growth than the primary nutrients. Zinc (Zn) and manganese (Mn) are micronutrients, which are required by the plant in very small amounts. Most secondary and micronutrient deficiencies are easily corrected by keeping the soil at the optimum pH value.

The major impact that extremes in pH have on plant growth is related to the availability of plant nutrients or the soil concentration of plant-toxic minerals. In highly acid soils, aluminum and manganese can become more available and more toxic to the plant. Also at low pH values, calcium, phosphorus and magnesium are less available to the plant. At pH values of 6.5 and above, phosphorus and most of the micronutrients become less available.

FACTORS AFFECTING SOIL pH

The pH value of a soil is influenced by the kinds of parent materials from which the soil was formed. Soils developed from basic rocks generally have higher pH values than those formed from acid rocks.

Rainfall also affects soil pH. Water passing through the soil leaches basic nutrients such as calcium and magnesium from the soil. They are replaced by acidic elements such as aluminum and iron. For this reason, soils formed under high rainfall conditions are more acidic than those formed under arid (dry) conditions.

Application of fertilizers containing ammonium or urea speeds up the rate at which acidity develops. The decomposition of organic matter also adds to soil acidity.

INCREASING THE SOIL pH

To make soils less acidic, the common practice is to apply a material that contains some form of lime. Ground agricultural limestone is most frequently used. The finer the limestone particles, the more rapidly it becomes effective. Different soils will require a different amount of lime to adjust the soil pH value. The texture of the soil, organic matter content and the plants to be grown are all factors to consider in adjusting the pH value. For example, soils low in clay require less lime than soils high in clay to make the same pH change.

Selecting a Liming Material: Homeowners can choose from four types of ground limestone products: pulverized, granular, pelletized and

hydrated. Pulverized lime is finely ground. Granular and pelletized lime are less likely to clog when spread with a fertilizer spreader over turf areas. The finer the grind of the limestone the faster it will change the soil pH value. Hydrated lime should be used with caution since it has a greater ability to neutralize soil acidity than regular limestone.

Time of Application and Lime Placement: Lime needs should be determined by a soil test. For more information on soil testing, refer to HGIC 1652. Soil samples should be taken in the fall for the succeeding year's garden. If test results indicate a need for limestone, it can be applied in the fall or winter months. Generally, for best results, limestone should be applied two to three months prior to planting to allow time for it to neutralize the acidity.

The most important factor determining the effectiveness of lime is placement. Maximum contact of lime with the soil is essential. Most liming materials are only slightly soluble in water, so incorporation in the soil is a must for lime reaction. Even when properly mixed with the soil, lime will have little effect on pH if the soil is dry. Moisture is essential for the lime-soil reaction to occur. In the case of lawns, it can only be surface applied and watered into the soil.

Wood Ashes: Wood ashes can be used to raise the soil pH. They contain small amounts of potassium, phosphate, boron and other elements. They are not as effective as limestone but with repeated use, they can drastically raise the pH value of a soil, especially if the soil is sandy in texture. Ashes should not come in contact with germinating seedlings or plant roots as they may cause damage. Spread a thin layer during the winter and incorporate into the soil in the spring. Check the soil pH annually especially if you use wood ashes. Avoid using large amounts of wood ashes because excessively high pH values and subsequent nutrient deficiencies may result. Coal ashes do not have any lime value and may actually be acidic dependent on the source.

DECREASING THE SOIL pH

Many ornamental plants and some fruit plants such as blueberries require slightly to strongly acid soil. These species develop iron chlorosis when grown in soils in the alkaline range. Iron chlorosis is often confused with nitrogen deficiency because the symptoms (a definite yellowing of the leaves) are similar. Iron chlorosis can be corrected by reducing the soil pH value.

Two materials commonly used for lowering the soil pH are aluminum sulfate and sulfur. These can be found at a garden supply center. Aluminum sulfate will change the soil pH instantly because the aluminum produces the acidity as soon as it dissolves in the soil. Sulfur, however, requires some time for the conversion to sulfuric acid with the aid of soil bacteria. The conversion rate of the sulfur is dependent on the fineness of the sulfur, the amount of soil moisture, soil temperature and the presence of the bacteria. Depending on these factors, the conversion rate of sulfur may be very slow and take several months if the conditions are not ideal. For this reason, most people use the aluminum sulfate.

Both materials should be worked into the soil after application to be most effective. If these materials are in contact with plant leaves as when applied to a lawn, they should be washed off the leaves immediately after application or a damaging leaf burn may result. Take extreme care not to over-apply the aluminum sulfate or the sulfur.

You can use the following tables to calculate the application rates for both the aluminum sulfate and the sulfur. The rates are in pounds per 10 square feet for a loamy soil. Reduce the rate by one-third for sandy soils and increase by one-half for clays.

Pounds of Aluminum Sulfate to Lower the pH

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
8.0	1.8	2.4	3.3	4.2	4.8
7.5	1.2	2.1	2.7	3.6	4.2
7.0	0.6	1.2	2.1	3.0	3.6
6.5		0.6	1.5	2.4	2.7
6.0			0.6	1.5	2.1

Pounds of Sulfur to Lower the Soil pH

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
8.0	0.3	0.4	0.5	0.6	0.7
7.5	0.2	0.3	0.4	0.5	0.6
7.0	0.1	0.2	0.3	0.4	0.5
6.5		0.1	0.2	0.3	0.4
6.0			0.1	0.2	0.3

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