

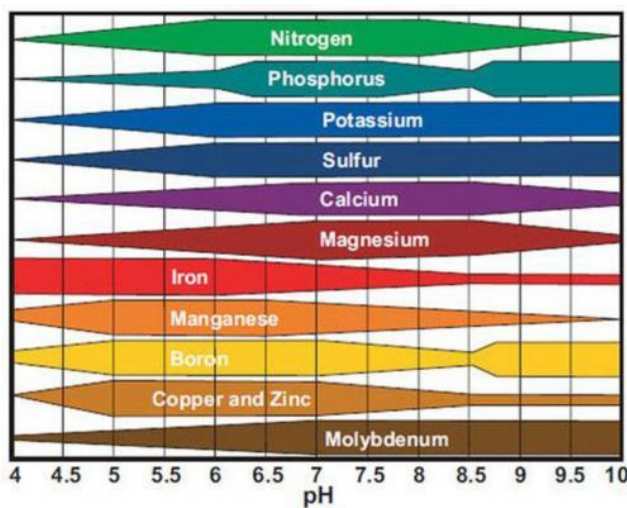
What Is Soil pH?

The acidity of a soil is measured in units called pH. A soil that is neither acidic nor alkaline has a pH of 7. A pH value below 7 is acidic; above 7 is alkaline.



Acidity is determined by the amount of hydrogen ions in the soil solution. An acidic soil has an abundance of hydrogen ions, whereas an alkaline soil has a deficiency of hydrogen ions. Each whole number of pH represents a 10-fold change in acidity. For example, pH 6 has 10 times the hydrogen ions of pH 7.

Most crops perform best when the soil is neither too acidic nor too alkaline. For many crops, a soil pH somewhere between 6.2 and 7.5 works well. In this range, most plant nutrients are chemically available to plant roots.



Nutrient Availability at Different pH Values

There are many exceptions, but most soils in California are slightly alkaline.

Many factors influence the soil pH: fertilizers, organic material, soil texture, irrigation water, and natural minerals in the soil. The most dominant factor controlling soil pH in most western soils is the abundance of calcium which tends to increase alkalinity and resists changes to soil pH.

Amendments can be added to soil to adjust the pH to a desired level. This can be a slow process and may take more than a year. Be patient with the process.

Measuring Soil pH

A soil test conducted by a laboratory will be the most accurate way to determine soil pH; however, it is possible to test your own soil pH.

There are many devices marketed as pH meters, but only a few actually measure pH. To find a soil's pH either use litmus test strips or a digital pH meter with a bulb-shaped probe. These

meters can be purchased inexpensively online or at tool supply store for under \$20. When purchased, their calibration can be incorrect. Follow your meter’s calibration instructions to improve accuracy.

There are several ways soil pH can be measured, but a good technique for home gardeners is to collect a soil sample and add to it an equal amount of distilled water. Stir until the mixture resembles a slurry. Let the mixture set for 15 minutes. Stir again and take your measurement.

Increasing Acidity

In many areas of California, particularly the drier regions, it is necessary to increase the acidity of the soil—to lower the pH. This is usually accomplished in gardens by adding elemental sulfur to the soil.

A common symptom of plants grown in alkaline soil is yellowing of new growth caused by a lack of available iron.

Compost is slightly acidic and will contribute to lowering pH. It also provides many other benefits to soil health, but alone, applied in reasonable amounts, it is unlikely to correct alkaline soils.

The following table shows how much elemental sulfur is needed to lower the soil pH to a desired level. Applying too much sulfur to a soil can harm your crops. Apply no more than 15 pounds per 1,000 ft² at a single application. Wait 6 months, re-test, and apply more sulfur if needed at that time.

Pounds of Elemental Sulfur to Add to Soil per 1,000 ft² to Lower pH

| Initial Soil pH | Desired Soil pH | | | | | | | | | | | | | | |
|-----------------|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 5.0 | | | 5.5 | | | 6.0 | | | 6.5 | | | 7.0 | | |
| | Sand | Loam | Clay | Sand | Loam | Clay | Sand | Loam | Clay | Sand | Loam | Clay | Sand | Loam | Clay |
| 5.5 | 4 | 10 | 16 | 0 | 0 | 0 | | | | | | | | | |
| 6.0 | 8 | 20 | 32 | 4 | 10 | 16 | 0 | 0 | 0 | | | | | | |
| 6.5 | 12 | 29 | 47 | 8 | 20 | 32 | 4 | 10 | 16 | 0 | 0 | 0 | | | |
| 7.0 | 15 | 38 | 61 | 12 | 29 | 47 | 8 | 20 | 32 | 4 | 10 | 16 | 0 | 0 | 0 |
| 7.5 | 19 | 48 | 77 | 15 | 38 | 61 | 12 | 29 | 47 | 8 | 20 | 32 | 4 | 10 | 16 |
| 8.0 | 23 | 57 | 92 | 19 | 48 | 77 | 15 | 38 | 61 | 12 | 29 | 47 | 8 | 20 | 32 |

Important: Do not apply more than 15 lbs. / 1,000 ft² in one application. Re-test in 6 months before adding more sulfur.

(From Allen, Tracy. Adjusting Soil pH. UMass Extension Soil and Plant Testing Laboratory. https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/spttl_3_adjusting_soil_ph_0.pdf. Accessed June 18, 2019.)

Reducing Acidity

Many fertilizers and amendments can, over time, lower soil pH, or you may live in an area with naturally acidic soils. Sometimes it is necessary to raise a soil’s pH to reduce its acidity and make it more alkaline. Most soils in California will not need their pH raised to become more alkaline.

When soil pH needs to be raised, it is usually accomplished in the home garden by using pulverized limestone or dolomite. These materials react with the acid in the soil, much like an antacid works to relieve heartburn.

Limestone and dolomite move in and react with soil *very slowly*. If an adjustment is needed to raise soil pH, it is best to begin this process before planting to allow time for the reaction to occur.

The amount of limestone or dolomite to apply to a soil is difficult to determine without a soil test. The pH that you measure is the acidity of the water in the root zone, but it does not tell you much about the composition of soil itself. The quantity to apply is related to the amount of calcium in the soil, soil texture, and other factors that are not easy to test for at home.

If your pH test indicates that you need to raise soil pH, then the best way to determine how much limestone or dolomite to apply is to obtain a soil test from a laboratory. If a laboratory soil test cannot be obtained, a good starting place to raise pH approximately 1 point is to apply limestone or dolomite is as follows: sand, 20 lbs./1,000 ft²; loam, 45 lbs./1,000 ft²; clay loam, 90 lbs./1,000 ft². Re-test your pH value in 1 year.

The choice of whether to use dolomite or limestone is based on your need for magnesium in the soil. Areas such as the serpentine regions in the Coast Ranges have high levels of magnesium in the soil and do not need dolomite; however, many areas of the state are deficient in magnesium. When the soil pH needs to be raised, dolomite is the product to choose in soils lacking magnesium. Limestone only provides calcium.

Without a soil test, the only possible way to tell if your soil is deficient in magnesium or other elements is to learn to identify nutrient deficiency symptoms in landscape plants.

Gardeners are often tempted to use products such as wood ashes, hydrated lime, or other products to soil to affect pH. While these can be effective, they are easy to misapply. Limestone and dolomite are less likely to cause unwanted effects in the garden than other products.

Be Patient

Adjusting soil pH is never a quick process. Exercise patience after applying any amendments to raise or lower pH.

Remember you can always apply more amendment later, but you cannot readily remove it once applied. Regular testing of pH will help you to determine if you need to apply additional products at a later date.

Testing soil pH annually during the same time of year, under similar conditions will help improve the reliability of your results and enable you to interpret changes that occur over time.

For More Information

- California Master Garden Handbook
- Vossen, Paul. Changing pH in Soil. <https://vric.ucdavis.edu/pdf/soil/ChangingpHinSoil.pdf>
- NRCS Soil Health Website: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>