

Lowering the Soil pH with Sulfur.

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Blueberries prefer acid soils with a pH of 4.5 to 5.5. With the popularity of blueberries many people are interested in quickly adjusting their soil pH. Acidifying soil is not an exact science; this handout is just a guide. The cheapest way to lower the soil pH is to add elemental sulfur to the soil. Soil bacteria change the sulfur to sulfuric acid, lowering the soil pH.

If the soil pH is greater than 5.5, apply elemental sulfur (**S**) to decrease the soil pH to 4.5 (see Table 1). Spring application and incorporation work best. Soil bacteria convert the sulfur to sulfuric acid lowering the soil pH. It is important to note that this is a biological process (slow) and not a chemical reaction (rapid). The bacteria are active, when the soil is moist and warm. The soil temperature needs to be above 55F. The bacteria are not active in the winter so fall applications of sulfur have little effect on the soil pH next spring. In addition, the soil must not be saturated, or flooded (anaerobic) or the sulfur is converted to hydrogen sulfide (rotten egg smell) by anaerobic bacteria. Hydrogen sulfide kills plant roots. Irrigate to maintain soil moisture but do not over irrigate the soil. This causes flooding and anaerobic conditions. Most Michigan irrigation water is high in alkalinity (dissolved lime) and will gradually raise the soil pH.

The amount of sulfur required is dependent on soil texture. Clay and organic matter act as a buffer, absorbing and releasing mineral ions. Relatively little sulfur is needed on sands, whereas soils high in clay or organic matter require much more. It is important to apply and incorporate sulfur at least a year before planting. This allows the sulfur time to react and lower the soil pH before planting. Do not assume that the change can be completed in a short time. If large changes in pH are needed, than the change will that longer than a small change.

Current pH	Soil type		
	Sand	Loam	Clay
5.0	175	530	800
5.5	350	1030	1600
6.0	530	1540	2300
6.5	660	2020	3030
7.0	840	2560	3830

¹To substitute ferrous sulfate, multiply by 8.

Sulfur cannot be easily incorporated to the soil after plants are present. Surface-applied sulfur provides the same pH reduction as incorporated material, but takes longer. Check soil pH again before planting and apply additional sulfur if needed. Do not apply more than 400 lb. sulfur per acre at a time to established plantings. When large amounts are needed, spread the application out over several years. Cultivation to aerate the soil and irrigation to maintain soil moisture can speed the process

Ferrous sulfate also decreases soil pH, but it is more costly to use than sulfur. Eight times more ferrous sulfate is needed than elemental sulfur. The ferrous sulfate reaction is quicker, since this salt disassociates into iron and sulfuric acid. The iron binds to the clay or precipitates out of the soil solution leaving the sulfuric acid. Aluminum sulfate also acidifies soils, but there are reports that it can be toxic to blueberries if high rates are applied. Many people want to change the soil pH right now! To do this you need to add acid to the soil. Some growers have even irrigated with dilute sulfuric acid to lower the soil pH. This can cause problems for some irrigation systems. Very acidic water gradually corrodes metal pipes and fittings, and can cause injury if applied directly on plants.

Potential blueberry growers with high pH soils on their potential site need to know the soil texture to determine the amount of sulfur to apply to the site. Soil samples may not give a texture but always give a value for the CEC or Cation Exchange Capacity. The CEC can be used to estimate soil texture. Below are the CEC ranges used to estimate soil texture by the Michigan State University's [Soil & Plant Nutrient Laboratory](#).

The CEC or Cation Exchange Capacity can be used to estimate soil texture

General range of CEC for different soil texture groups:	
Soil Type	CEC
Loamy sand:	< 5 meq/100 g
Sandy loam:	6-8 meq/100 g
Loam:	9-12 meq/100 g
Clay loam:	12-17 meq/100 g

For example, if your soil sample had a soil pH of 6.5 and a CEC of 12-meq/100 g, this suggests a loam soil. Table 1 indicates over 2000 lb. of S per acre would be needed to reduce the soil pH, 2 pH points, to 4.5. Each pH point is 10 times the value of other points. Two pH points will not double the soil acidity but increase it 100 times. This is a large shift in pH and unlikely to be accomplished quickly. Not a few days or weeks but one or more probably two years.

Ideally, 2,000#/A of sulfur would be applied early in the season the year before planting and the pH would be checked again in the fall and the following spring. If the soil pH was below 5.5 then blueberries could be planted in the spring. If the soil pH was high in the fall and still high in the spring more sulfur should be added before the fall planting of blueberries.

Since more than 400 lb. S should not be applied more than once a year to established plants, correcting the pH here will require 5 years of 400 lb. applications in the spring if the pH was not corrected before planting. I doubt the poor growth of the planting while the pH is being corrected would justify the time saved by planting before the pH was in the 4.5 to 5.5 range.

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