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Feeds Forages Mycotoxins Soils Plant Tissues Manure Fertilizers Lime Water

Fertilizers & Soil Acidity

Some soils are alkaline, with soil pH's of 7.4 or greater. While many plants tolerate these pH levels, lowering the pH to near neutral or slightly below can improve performance of many plant species. Iron and zinc in particular become more available to plants if soil pH is slightly acidic. The best time to adjust pH in alkaline soils is before planting when sulfur can be incorporated. Sulfur and gypsum are slowly soluble, and surface applications to soil are not as effective as incorporation. Many fertilizers react in soil to form acids and can have some effect on soil pH.

There is a standard index for comparison of the acidity of different fertilizers. This standard is called the Calcium Carbonate (CaCO_3) equivalent. This number, often found on fertilizer labels or spec sheets, gives the number of pounds of Calcium Carbonate (CaCO_3), that would be needed to neutralize a ton of the fertilizer in question. In the table below are some fertilizers and their equivalent acidity (-) or basicity (+) in pounds of Calcium Carbonate (CaCO_3) per ton.

<u>Fertilizer Material</u>	<u>Analysis</u>	<u>(lbs. CaCO_3 per ton)</u>
Aluminum Sulfate	00-00-00-14S	- 824
Ammonium Nitrate	34-00-00-00	- 1,180
Ammonium Sulfate	21-00-00-24S	- 2,200
Anhydrous Ammonia	82-00-00-00	- 2,960
Aqua Ammonia	16-00-00-00	- 720
Aqua Ammonia	25-00-00-00	- 1,080
Bone Meal	04-28-00-00	+ 500
Calcium Nitrate	15-00-00-00S-19Ca	+ 400
Calcium Sulfate	00-00-00-16S-22Ca	neutral
Dolomite	00-00-00-00S-21Ca	+ 1960
Ferric Sulfate	00-00-00-17S	- 978
Magnesium Sulfate Heptahydrate	00-00-00-14S-10Mg	neutral
Phosphate, Diammonium	18-46-00-00S	- 1,400
Phosphate, Monoammonium	11-52-00-00S	- 1,300
Phosphate, Phosphoric Acid	00-60-00-00	- 1,400
Potassium Chloride	00-00-60-00	neutral
Potassium Nitrate	13-00-44-00	+ 520
Potassium Magnesium Sulfate	00-00-22-11S	neutral
Potassium Sulfate	00-00-52-17S	neutral
Sodium Nitrate	16-00-00-00	+ 580
Sulfur, Elemental	00-00-00-90S	- 4,620
Superphosphate, Single	00-20-00-00	neutral
Superphosphate, Triple	00-46-00-00	neutral
Urea	46-00-00-00	- 1,680
Urea Ammonium Nitrate Solution	28-00-00-00	- 1,000
Urea Formaldehyde	38-00-00-00	- 1,360

In most situations, fertilizer has little effect on pH because relatively small quantities are applied and the Calcium Carbonate (CaCO₃) equivalent of many fertilizer materials is low. Fertilizers are not usually considered agents of major short-term pH change, but continued use of high rates of fertilizers with high Calcium Carbonate (CaCO₃) equivalents will lower soil pH.

Reducing Soil pH

Reducing soil pH can be achieved by adding acidifying materials such as elemental sulfur. High soil pH is often a natural condition and repeated sulfur applications may be necessary to maintain the desired pH. Availability of soil nutrients will be affected by changes in soil pH. High application rates of acidifying materials can also increase soluble salts to levels that can injure plants.

Elemental sulfur is the material most commonly used to reduce soil pH. Care should be taken in handling the material due to its highly corrosive nature. Table 1 shows the amount of sulfur required in various soils to lower the pH to 6.5. The reaction of sulfur in the soil is relatively slow and may take a year before the full effect on soil pH is achieved.

Table 1. Approximate amounts of elemental Sulfur required to reduce soil pH to 6.5 to a depth of 7 inches in a carbonate-free soil.

<u>Initial Soil pH</u>	<u>Lbs of Elemental Sulfur Required / Acre To Lower Soil pH To 6.5 *</u>		
	<u>Sand</u>	<u>Loam</u>	<u>Clay</u>
8.5	2,000	2,500	3,000
8.0	1,200	1,500	2,000
7.5	500	800	1,000
7.0	100	150	300

* Western Fertilizer Handbook, 8th Edition.

Blueberries and other acid-loving crops require a very low soil pH for optimum growth and production. Suggested rates of elemental sulfur to lower the soil pH to 4.5 are presented in Table 2.

Table 2. Approximate amount of elemental Sulfur required to reduce soil pH to 4.5.

<u>Initial Soil pH</u>	<u>Lbs of Elemental Sulfur Required / Acre To Lower Soil pH To 4.5 **</u>		
	<u>Sand</u>	<u>Loam</u>	<u>Clay</u>
7.0	840	2,550	3,830
6.5	660	2,020	3,000
6.0	530	1,540	2,310
5.5	350	1,050	1,600
5.0	175	530	800

** Highbush Blueberry Production, PNW215, Oregon State University.

Other acidifying materials may be used to lower soil pH. Adjust the application rate based on the calcium carbonate (CaCO₃) equivalent. Be aware that other nutrients and elements may be added in excessive amounts. Acidifying materials containing sulfate (SO₄) will react faster with the soil than elemental sulfur (S). Materials should be incorporated and thoroughly mixed with the soil to obtain the quickest reaction.