Soil
FACTSHEET

BRITISH COLUMBIA | Ministry of Agriculture

Order No. 638.100-1
Revised December 2015
Created May 1991

Acidifying Soils

Sometimes it is desirable to lower soil pH to increase the availability of some plant nutrients. Acidification may be required on soils that are high in free carbonates; these have a pH of around 8.4 or above. Lowering soil pH involves the same cultural practices and considerations as raising it with liming, except that different products are required.

The principal agents used to lower soil pH are elemental sulfur, sulfuric acid, aluminum sulfate and iron sulfates (ferrous sulfate and ferric sulfates). Ammonium sulfate, ammonium phosphate and other ammonium containing fertilizers are also quite effective for reducing soil pH when soils receive sufficient water (rain and irrigation).

For large areas, elemental sulfur is probably the most economical product. However, elemental sulfur has to be oxidized by soil microorganisms (**Thiobacillus species**) to sulfuric acid to effect a reduction in soil pH. The rate at which soil pH will decrease is related to the activity of the soil microorganisms and the fineness of the sulfur compounds. Flowers of sulfur are very fine and have a large surface area; solid sulfur prills are convenient to apply but have a small surface area and usually has a lower reaction time.

Sulfuric acid can be used effectively for reducing soil pH as it does not rely on microbial oxidation; however, it is generally much more expensive, it is also unpleasant to handle and is very corrosive. Generally, elemental sulfur when fully converted to sulfuric acid will react with threefold its applied weight of residual limestone. As with liming soils, limiting the maximum applied rate to about 2 tonnes per hectare (about a ton per acre) will lower soil pH gradually while preventing or minimizing the chance of a salt buildup. Soil test laboratories can determine the total soil acid and sulfur requirement to attain a desirable soil pH on request.

Comments on acidifying soils and material are presented in the following sections.

1. Soil pH

- The soil pH does not indicate how much acidifying material is required to lower soil pH to a specified level.
- If the soil pH is above 8.4, it probably contains significant quantities of sodium carbonate and bicarbonates.
- If the soil contains more than 10% Exchangeable Sodium Percentage (ESP), you may need gypsum before leaching to improve soil structure.

2. Sulfur

- One tonne of sulfur converted to sulfuric acid will react with three tonnes of residual limestone.
- One tonne of sulfur is equivalent to three tonnes of sulfuric acid and 6.9 tonnes of aluminum sulfate.
- Elemental sulfur will not change soil pH before it is oxidized to sulfuric acid by soil micro-organisms. The activity and amounts of these microbes determine the conversion rate.

- A soil layer of 20 cm. in depth and containing 1% residual carbonate contains 20 tonnes of unreacted limestone and will require about 6.6 tonnes of sulfur to neutralize. At $275/tonne that would cost $1800/hectare.

3. Gypsum [$CaSO_4 \cdot 2H_20$]

- Gypsum applications will not acidify soils. Acidification can be produced by adding flowers of sulfur, sulfuric acid, aluminum sulfate, iron sulfate and many nitrogenous fertilizers.
- Gypsum may be used on high-sodium soils to improve soil structure, whether or not free calcium carbonate is present in the surface soil.
- Applying gypsum or acidifying agents to soils low in available potassium or magnesium may cause a deficiency of these elements induced by high soil-solution calcium/sodium levels.

4. Ammonium Sulphate [$(NH_4)_2SO_4$]

- Ammonium sulphate is the most acidifying nitrogen fertilizer, containing 21% nitrogen and 24% sulfur (21-0-0-245).
- Ammonium sulphate is effective in acidifying small areas of high pH soils, especially when applied in bands for row crops.
- Large volumes of ammonium sulphate are required over long periods to effectively acidify fields with very high pH's, but will cause a noticeable decline in soils that initially have low pH.

5. Iron and Aluminum Sulphates

- Iron and aluminum sulphates are usually used to acidify small soil areas in lawns and gardens, especially for ornamental shrubs.
- Ferrous sulphate – $FeSO_4 \cdot 7\ H_20$
  Ferric sulphate – $Fe_2(S0_4)_3 \cdot 9\ H_20$
  Aluminum sulphate – $Al_2\ (SO_4)_3 \cdot 18\ H_20$

6. Irrigation, Drainage and Leaching

- Removal of sodium by draining, and leaching with good quality water can lower soil pH when sodium contents are high.
- Surface and internal drainage of soils must be improved to allow removal of sodium and other salts in order to increase soil acidity.
- Irrigation water must be of good quality and not import excessive amounts of sodium, or other salts, especially in a poorly drained soil.

7. Peat

- Sphagnum peat can be mixed with soil to lower its pH and improve the quality of the root zone.
- Mixing acid sphagnum peat at a 1 to 1 volumetric ratio will neutralize the residual carbonate in a soil that contains 1% calcium carbonate equivalent.

FOR FURTHER INFORMATION CONTACT
Phone: 604.556.3001
Toll Free: 1.888.221.7141

MINISTRY OF AGRICULTURE
1767 Angus Campbell Road
Abbotsford, B.C. V3G 2M3