Agricultural lime

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Agricultural lime, also called **aglime**, **agricultural limestone**, **garden lime** or **liming**, is a soil additive made from pulverized limestone or chalk. The primary active component is calcium carbonate. Additional chemicals vary depending on the mineral source and may include calcium oxide, magnesium oxide and magnesium carbonate. Unlike the types of lime called quicklime (calcium oxide) and slaked lime (calcium hydroxide), powdered limestone does not require lime burning in a lime kiln; it only requires milling.

The effects of agricultural lime on soil are:

- it increases the pH of acidic soil (the lower the pH the more acidic the soil); in other words, soil acidity is reduced and alkalinity increased[1]
- it provides a source of calcium and magnesium for plants
- it permits improved water penetration for acidic soils
- it improves the uptake of major plant nutrients (nitrogen, phosphorus, and potassium) of plants growing on acid soils.[2]

Lime may occur naturally in some soils but may require addition of sulfuric acid for its agricultural benefits to be realized. Gypsum is also used to supply calcium for plant nutrition. The concept of "corrected lime potential"[3] to define the degree of base saturation in soils became the basis for procedures now used in soil testing laboratories to determine the "lime requirement" of soils.[4]

Other forms of lime have common applications in agriculture and gardening, including dolomitic lime and hydrated lime. Dolomitic lime may be used as a soil input to provide similar effects as agricultural lime, while supplying magnesium in addition to calcium. In livestock farming, hydrated lime can be used as a disinfectant measure, producing a dry and alkaline environment in which bacteria do not readily multiply. In horticultural farming it can be used as an insect repellent, without causing harm to the pest or plant.

Spinner-style lime spreaders are generally used to spread agricultural lime on fields.

Agricultural lime is injected into coal burners at power plants to reduce the pollutants such as NO_2 and SO_2 from the emissions.

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Determining the need for agricultural lime

The primary reason to apply agricultural lime is to correct the high levels of acidity in the soil. Acid soils reduce plant growth by inhibiting the intake of major plant nutrients (nitrogen, phosphorus and potassium).[5] Some plants, particularly legumes, will not grow in highly acidic soils. This is vital to maximise crop yield, animal grazing and good quality silage/hay.[6]

Soils become acidic in a number of ways. Locations that have high rainfall levels become acidic through leaching. Land used for crop and livestock purposes lose minerals over time by crop removal and become acidic. For example, when a 600 pound calf is removed from a pasture, 100 pounds of bone is also removed, which is 60% calcium compounds.[7] The application of modern chemical fertilizers is a major contributor to soil acid by the process in which the plant nutrients react in the soil.[8]

Aglime, which is high in calcium, can also be beneficial to soils where the land is used for breeding and raising foraging animals. Bone growth is key to a young animal's development and bones are composed primarily of calcium and phosphorus.[9] Young mammals get their needed calcium through milk, which has calcium as one of its major components. Dairymen frequently apply aglime because it increases milk production.

The best way to determine if a soil is acid or deficient in calcium or magnesium is with a soil test which can be provided by a university with an agricultural education department for under $30.00, if you live in the United States.[10] Farmers typically become interested in soil testing when they notice a decrease in crop response to applied fertilizer.

Quality

The quality of agricultural limestone is determined by the chemical makeup of the limestone and how finely the stone is ground. To aid the farmer in determining the relative value of competing agricultural liming materials, the agricultural extension services of several universities use two rating systems.[11] Calcium Carbonate Equivalent (CCE) and the Effective Calcium Carbonate Equivalent (ECCE) give a numeric value to the effectiveness of different liming materials.

The CCE compares the chemistry of a particular quarry's stone with the neutralizing power of pure calcium carbonate. Because each molecule of magnesium carbonate is lighter than calcium carbonate, limestones containing magnesium carbonate (dolomite) can have a CCE greater than 100 percent.[12]

Because the acids in soil are relatively weak, agricultural limestones must be ground to a small particle size to be effective. The extension service of different states rate the effectiveness of stone size particles slightly differently.[13] They all agree, however, that the smaller the particle size the more effective the stone is at reacting in the soil.[14] Measuring the size of particles is based on the size of a mesh that the limestone would pass through. The mesh size is the number of wires per inch.[15] Stone retained on an 8 mesh will be about the size of BB pellets. Material passing a 60 mesh screen will have the appearance of face powder. Particles larger than 8 mesh are of little or no value, particles between 8 mesh and 60 mesh are somewhat effective and particles smaller than 60 mesh are 100 percent effective.

By combining the chemistry of a particular product (CCE) and its particle size the Effective Calcium Carbonate Equivalent (ECCE) is determined.The ECCE is percentage comparison of a particular agricultural limestone with pure calcium carbonate with all particles smaller than 60 mesh.Typically the aglime materials in commercial use will have ECCE ranging from 45 percent to 110 percent.

Brazil's case

Brazil's vast inland cerrado region was regarded as unfit for farming before the 1960s because the soil was too acidic and poor in nutrients, according to Nobel Peace Prize winner Norman Borlaug, an American plant scientist referred to as the father of the Green Revolution. However, from the 1960s, vast quantities of lime (pulverised chalk or limestone) were poured on the soil to reduce acidity. The effort went on and in the late 1990s between 14 million and 16 million tonnes of lime were being spread on Brazilian fields each year. The quantity rose to 25 million tonnes in 2003 and 2004, equalling around five tonnes of lime per hectare. As a result, Brazil has become the world's second biggest soybean exporter and, thanks to the boom in animal feed production, Brazil is now the biggest exporter of beef and poultry in the world.[16]

See also

- Marl
- Liming (soil)
- Soil pH

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Further reading

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