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Limestone

Module 3.3-23 Calcium carbonate, the chief component of limestone, is a widely used amendment to neutralize soil acidity and to supply calcium for plant nutrition. The term "lime" can refer to several products, but for agricultural use it generally refers to ground limestone.

Production. Limestone is a common sedimentary rock found in widespread geologic deposits. It has been used throughout much of recorded history as a building material, a cementing agent, and in agriculture to improve acid soils. An agricultural liming material (ag lime) is broadly defined as any substance containing Ca or Mg and capable of neutralizing acidity. Many materials can be classified as ag lime.

Ag lime is extracted from quarries or mines and usually requires mechanical crushing. The fineness of the ag lime is important in determining how quickly it reacts with soil acidity. Limestone of a smaller particle size reacts quickly since there is more exposed surface area for chemical reaction. Larger particles are slower to react, but provide a sustained, longer term source of acid neutralization. A measurement of particle size is typically reported on the product label.

Other materials in the ag lime, such as clay, will reduce its purity and diminish the acid-neutralizing capacity. Ag lime effectiveness is rated based on its comparison with pure calcium carbonate ($CaCO_3$), a value that is expressed as the percent calcium carbonate equivalent (CCE). Ag lime is more soluble in acid soils than in neutral or alkaline soils. The presence of $CaCO_3$ in soil is detected by the effervescence or 'fizz' when a drop of strong acid is applied.

Chemical Properties

Limestone/Calcite – calcium carbonate [$CaCO_3$] Mostly insoluble in water, but solubility increases in acid conditions (contains a maximum of 40% Ca).
Dolomite – calcium magnesium carbonate [$Ca{\cdot}Mg(CO_3)_2$] Mostly insoluble in water, but solubility increases in acid conditions (contains between 2 to 13% Mg).
Hydrated/Slaked lime – calcium hydroxide [$Ca(OH)_2$] Relatively insoluble in water; forms a solution of pH >12.
Burned lime/Quick lime – calcium oxide [CaO] Reacts with water to form hydrated lime.

Agricultural Use. The primary use of ag lime is to raise the pH of acid soils and reduce the concentration of aluminum (Al) in soil solution. Poor crop growth in acid soils is largely due to soluble Al, which is toxic to the root system of many plants. Lime will reduce soluble Al by two reactions:

1) $CaCO_3 + H_2O \rightarrow Ca^{2+} + 2OH^- + CO_2$
2) Al^{3+} [soluble] + $3OH^- \rightarrow Al(OH)_3$ [insoluble]

Additions of ag lime also supply valuable Ca (and possibly Mg) for plant nutrition. Some secondary benefits of neutralizing soil acidity with ag lime include:

- Increased P availability
- Improved N fixation by legumes
- Enhanced N mineralization and nitrification
- Better water use, nutrient recovery, and plant performance with a healthier root system

Management Practices. The quantity of ag lime needed to bring a soil to a desirable pH range can be easily determined in the laboratory. Ag lime is most commonly spread uniformly on the soil and then mixed through the root zone. Neutralizing soil acidity is not a one-time process, but must be repeated periodically depending on the soil and environmental conditions. Typical application rates are measured in tons per acre.

Non Agricultural Uses. Limestone is one of the most widely utilized of all earth materials. In addition to its use in building and construction, limestone is used in diverse applications such as air pollution control, treatment systems for drinking water and waste water, soil stabilization, medicines, antacids, and cosmetics.

Source: http://www.ipni.net/specifics