

# Liming of acid soils is a must

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Soil acidity is one of the most important soil problems which baffle modern agriculturists in their effort to enhance the production of their crops by intensive cultivation. Some of the factors responsible for the development of acid soils are listed below:

1. Soils developed from acidic parent materials.
2. Loss of calcium and other bases from soil by erosion, leaching, and crop removal.
3. During the process of absorption, plant roots secrete hydrogen ions into the soil which helps to make soil more acid.
4. The use of acid-forming fertilizers like ammonium sulphate, urea etc. and acidulents like sulphur and aluminium sulphate.

5. The formation of organic and inorganic acids in soils during the process of organic matter decomposition.

Majority of crop plants do not yield their maximum potential on strongly acid soils. Toxicities of aluminium and manganese and deficiencies of calcium, magnesium, phosphorus and molybdenum are some of the factors commonly attributed for poor yield under strongly acid conditions, particularly when the organic matter content of the soil is low.

Besides supplying the essential nutrient calcium (and magnesium if the lime is dolomitic) liming controls the solubility and availability of various nutrient ions, stimulates mineralisation of organic nitrogen, phosphorus and sulphur, encourages nitrification, enhances fixation of nitrogen by

symbiotic and free-living organisms, and monitors the physiological balance of nutrients in the soil. Aluminium, manganese and iron are rendered less soluble and harmless when the soil is well supplied with lime. Liming corrects soil acidity, improves the physical conditions of the soil and encourages the activity of beneficial soil bacteria. In acid soils, phosphorus (native as well as fertilizer phosphorus) combines with iron and aluminium forming relatively insoluble phosphates. Liming reduces the solubility of iron and aluminium so that less phosphorus is held in these relatively unavailable forms and thereby the availability of phosphorus is increased. Liming reduces the luxury absorption of potassium by plants when present in excess. The loss of nitrogen from acid soils is also reduced by the application of lime. Judicious use

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of lime on acid soils has been found to increase the yield of most crop plants in various parts of the world.

In agriculture, the word lime means any calcium or calcium and magnesium containing compound that is capable of reducing the acidity of the soil. The common liming materials used for liming acid soils are given below:

1. **Limestone.** The naturally occurring rock minerals consisting chiefly of calcium carbonate or calcium and magnesium carbonates are known as limestones. When the magnesium carbonate content is significant, the material is known as dolomitic limestone, otherwise it is called calcitic limestone. Limestone is available in abundance in almost every country including India. It is the most commonly

used liming material and has many advantages over other forms of agricultural limes. It is used as such after grinding into finer grades. Dolomitic limestone is preferred on soils deficient in magnesium.

2. **Dolomite.** Dolomite is the naturally occurring mineral calcium - magnesium carbonate, with the ideal composition  $\text{Ca Mg}(\text{CO}_3)_2$ .
3. **Burnt lime (Quick lime).** obtained after burning limestone or oyster shells.
4. **Hydrated (slaked) lime.** obtained after hydrating the burnt lime.
5. Ground oyster shells
6. Calcium silicate slags-a by-product of iron industry.

**Amount and method of application of lime**

It is commonly accepted that all

the major nutrients are best available at a pH range of 6.5 to 7.5 while the micro-nutrients except molybdenum at a pH range of 5.0 to 6.5. The availability of molybdenum is limited below pH 6.5 and molybdenum deficiency may be a potential factor limiting plant growth on acid soils. A pH range of 6.5 to 7.0 is therefore considered to be the best for mineral soils, as at this range all the essential nutrient elements are sufficiently available to meet the requirements of most crop plants for maximum yield in the majority of cases, and more so in a warm temperate region like India.

The approximate optimum pH ranges of some of the important crops suggested by Ignatieff (1958) are presented below:

Ignatieff, V. (Ed.)

1958 Efficient use of Fertilisers.

F. A. O., Rome

Crop	Optimum pH range
Barley	6.5 - 8.0
Banana	6.0 - 7.5
Coconut palm	6.0 - 8.0
Cotton	5.0 - 6.0
Groundnut	5.3 - 6.6
Rice	5.0 - 6.5
Sugarcane	6.0 - 8.0
Tobacco	5.5 - 7.5
Wheat	5.5 - 7.5

Once the pH requirement of the crop is known, the quantity of lime required for liming the soil to the desired pH level may be worked out by chemical test. More lime is usually needed to accomplish the same change in pH when the clay and organic matter contents of the soil are high. The requirement

of lime to change the pH also varies with the type of clay present as well as the initial pH of the soil. It is an established fact that the finer the lime particles the faster they react with the soil. Burnt lime and hydrated lime are more soluble than calcium carbonate or dolomite where as calcium silicate is

the least soluble. It is desirable to spread the lime uniformly over the entire area using a lime-spreader or otherwise and mixed well in the whole plough layer by ploughing. Large amounts of lime, when needed, should be applied in two applications, one half before ploughing and the other

half disked in at a later stage.

#### **Over-liming injury**

The application of lime in excessively large quantities may shift the pH of the soil above the optimum pH requirement of the crop and the crop response is adversely affected. The injurious effects can be due to one or more of the following factors.

1. The availability of boron may be reduced and its absorption and utilisation may be hindered.
2. Deficiencies of available iron, manganese, copper and/or zinc may be induced.
3. Availability of phosphorus

may be reduced to a critically low level due to the formation of complex insoluble calcium phosphates.

4. Drastic change in pH itself may cause plant injury.

#### **Rational use of lime**

The rational use of lime shall increase crop yields on acid soils by making more of other nutrients available for crop use. Such stimulation may exhaust the soil, and its productivity may drop back to even a lower level after a few years if the soil is not sufficiently replenished with other nutrients to meet the requirements of the crop for higher yields. To keep up the fertility,

lime application should be sufficiently supplemented with farm manure, crop residues and legumes, and fertilizers carrying nitrogen, phosphorus and potassium. When rationally supplemented liming becomes one of the most important factors in maintaining the productivity of acid soils.

This relationship is brought about by the adage:

“Lime and lime without manure  
Make the farm and farmer  
poorer,  
But, lime, manure, and vigorous  
clover  
Make the old farm rich all over”

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