

# CALCIUM FACTSHEET

December 2003

## CALCIUM IN SOILS

Calcium plays an important role in determining soil physical and chemical characteristics, i.e. structure and pH.

Calcium ions cause soil colloids (clay platelets) to bond or aggregate together, forming crumbs or peds. Soils dominated by calcium are friable and well-structured, have good internal drainage, and are easy to cultivate. They are often described as self-mulching. In contrast, sodium, and to a lesser extent magnesium, cause clay platelets to disperse. Soils dominated by sodium and/or magnesium have low infiltration rates, crust after rain, are puggy when wet, set hard on drying and are difficult to cultivate.

Exchangeable calcium levels and soil acidity are usually closely related. Calcium is most available in the pH range 7.0 to 8.5. Under low pH or acid soil conditions, exchangeable calcium levels in the soil are usually low, and the solubility of manganese and aluminium increase and may become toxic.

## CALCIUM IN PLANTS

Plants take up calcium in the ionic form ( $\text{Ca}^{2+}$ ). Uptake is not as efficient as for other plant nutrients. It occurs just behind the root tip, in contrast with potassium where uptake occurs along most of the length of the root. Consequently, anything that affects new root growth may prevent calcium uptake and induce a deficiency. This includes adverse weather conditions such as drought, low temperatures, high humidity, poor soil aeration and water logging. For example, "blossom-end" rot in tomatoes, which is attributed to inadequate calcium, can be induced by a period of moisture stress, even though the soil may have adequate calcium levels.

Competition also occurs with other cations, e.g. ammonium ( $\text{NH}_4^+$ ), potassium ( $\text{K}^+$ ) and magnesium ( $\text{Mg}^{2+}$ ) for root uptake.

Within plants, calcium is not mobile. Once calcium is deposited in leaves, it cannot be remobilised from them to the growing tips.

Calcium is required for cell elongation and cell division. Adequate calcium helps delay leaf senescence and slows down or prevents leaf and fruit fall (abscission).

## DEFICIENCY SYMPTOMS

Since plants are unable to utilise calcium from old leaves, deficiency normally occurs first in the growing points and youngest leaves. Roots are usually affected before the tops; with both roots and tops exhibiting die back of the growing point. Where calcium deficiency is moderate to acute, root growth is markedly impaired and plants become susceptible to root-rot infection.

Deficiency symptoms also occur in fruit or storage tissues. Some specific symptoms are :-

- "Bitter pit" in apples - small brown necrotic spots (2 - 3 mm deep and 2 - 3 mm in diameter) over the surface of the fruit.
- "Blossom-end rot" in tomatoes - breakdown at the flower end of the fruit, with depressed blackened patches which may be up to 3 - 5 cm across.
- "Black heart" in celery - deformed and chlorotic (yellow) growth. At a more advanced stage the leaf margins become necrotic (dead patches).
- "Pops" in peanuts - empty shells or small kernels in the pods.

## CALCIUM FERTILIZERS AND SOIL AMENDMENTS

In assessing the need to apply calcium and the form in which it is best applied, the soil pH should be considered in addition to the soil's calcium status. In very acid soils, calcium will need to be applied in a form which will raise the soil pH, e.g. lime, and at higher rates than are normally required to correct calcium deficiency alone.

**Lime (calcium carbonate)** is used on acid soils to correct acidity and supply calcium. Typical application rates are in the range of 2.5 to 7.5 t/ha. Lime is insoluble, and takes time to react in the soil. In annual crops, it should be applied several months ahead of planting and be incorporated into the soil. The effectiveness of lime is therefore very dependent on its particle size. Lime that is coarser than 250 microns (0.25mm) has little value in raising soil pH, at least in the short term.

**Gypsum (calcium sulfate)** is used as both a calcium fertilizer, e.g. over the row in peanuts after planting, and as a sulfur fertilizer, e.g. in pastures on high phosphorus soils. The major use of gypsum, however, is at higher rates as a soil amendment (or ameliorant), to improve soil structure and reduce surface crusting. Lime is unsuitable for such uses on neutral to alkaline soils, as it is insoluble. Lime will not dissolve and react in the soil unless the soil is acid. When used as a soil amendment, gypsum, like lime, needs to be applied well ahead of planting. Gypsum has little or no effect on soil pH.

**Superphosphate.** Single Superphosphate, e.g. SuPerfect, and Triple Superphosphate both contain calcium. These products are used to supply phosphorus, and it is the required rate of phosphorus that dictates their application rate. Their use, however, can contribute to the calcium requirement of crops and pastures where the soil is low in calcium.

**Calcium nitrate**, e.g. Hydro Calcinit, is used where calcium is to be applied in solution, e.g. as a foliar spray or through fertigation systems, i.e. dissolved in irrigation water, and/or where a quick response to calcium is required. Calcium nitrate foliar sprays are commonly used as a preventative measure in horticultural crops that are susceptible to calcium deficiency.

Calcium nitrate is also used as a non-acidifying nitrogen fertilizer, through drip and trickle irrigation systems and under tree sprinklers. Because of its cost, the use of calcium nitrate is largely restricted to high value horticultural crops.

### FURTHER READING

An Agritopic on "Calcium" is available if more detailed information is required.

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