FERTFACTS

CALCIUM
FACT SHEET

CALCIUM IN SOILS

Calcium is an important plant nutrient. It also plays an important role in determining soil physical and chemical parameters, 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 (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 (NH_4^+), potassium (K^+) and magnesium (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 of calcium deficiency are listed at the top of the next page:-

- "Bitter pit" in apples - small brown necrotic spots (2 - 3 mm in depth and 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 5 cm wide.
- "Black heart" in celery - deformed and chlorotic (yellow) growth. At a more advanced stage the leaf margins become necrotic, i.e. dead patches will be evident at the edges.
- "Pops" in peanuts - empty shells or small kernels in the pods.

CALCIUM FERTILISERS AND SOIL AMENDMENTS

A number of factors have to be considered in assessing the need to apply calcium and the form and rate at which it is best applied. Calcium compounds need to be applied at higher rates to correct soil acidity or to improve soil structure than where calcium only needs to be applied for its nutritional value. The crop's value and susceptibility to calcium deficiency and its impact on yield and quality are important considerations, as well as the price of the calcium compound to be applied.

Acid (low pH) Soils: In very acid soils calcium will need to be applied in a form which will correct acidity. **Lime** (calcium carbonate) or some other liming material needs to be used. Typical application rates for lime 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, e.g. at the start of the fallow period. Timing is less critical in tree crops where it is normally applied in winter, in advance of the spring flush and the main growing season. Being insoluble the effectiveness of lime is 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.

Poorly Structured (Sodic) Soils: Unless the soil is also acidic in which case lime can be used, the soil ameliorant that should be used to improve the structure of sodic soils is **Gypsum** (calcium sulphate). Application rates are typically in the range of 5 – 10 t/ha. While only sparingly soluble, gypsum is much more soluble than lime allowing it to be used on all soil types, irrespective of the pH. Lime is unsuitable for use on neutral to alkaline soils as it is insoluble.

It will not dissolve and react in the soil unless the soil is acid. Like lime, gypsum needs to be applied well ahead of planting and to be thoroughly incorporated into the soil. This allows time for calcium to displace sodium from the surface of clay platelets in the soil. Gypsum has little or no effect on soil pH. It will not correct soil acidity. In addition to being used as a soil ameliorant, gypsum may be used at lower rates as a calcium fertiliser, e.g. over the row in peanuts after planting, and as a sulphur fertiliser, e.g. in legume based pastures on high phosphorus soils.

Preventative Treatment to Safeguard against Calcium Deficiency in High Value Horticultural Crops: Calcium nitrate (**Yara Calcinit**) is completely soluble and can be used where calcium is to be applied in solution, either as a foliar spray or dissolved in irrigation water (fertigation). Calcium nitrate is used where a quick response to calcium is required and in high value crops that are susceptible to calcium deficiency, even where the soil is well endowed with calcium or has recently been limed. Calcium nitrate may also be used as a non-acidifying nitrogen fertiliser through drip and trickle irrigation systems and under tree sprinklers. The use of calcium nitrate is largely confined to high value horticultural crops on account of its high price compared to lime and other products.

Incidental Application of Calcium as a Constituent of Other Fertilisers: Calcium is present in many fertilisers and blends. Single Superphosphate (**SuPerfect**) and Triple Superphosphate (**Triple SuPer**) 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.

FURTHER READING

For further information, a copy of the Incitec Pivot Agritopic on "Calcium" is available if more detailed information is required. These can be obtained from your Incitec Pivot Fertiliser distributor.

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