FACT SHEET

August 2021

CALCIUM

CALCIUM (Ca) 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 Ca are friable and well-structured, have good internal drainage, and are easy to cultivate. They are often described as self-mulching.

In contrast sodium (Na), and to a lesser extent magnesium (Mg), cause clay platelets to disperse. Soils dominated by Na and/or Mg have low infiltration rates, crust after rain, are puggy when wet, set hard on drying and are difficult to cultivate.

Exchangeable Ca 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 Ca levels in the soil are usually low, and the solubility of manganese (Mn) and aluminium (Al) 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 Ca 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 positively charged cations, e.g. ammonium (NH_4^+), potassium (K^+) and magnesium (Mg^{2+}) for root uptake.

Within plants, Ca is not mobile. Once Ca is deposited in leaves, it cannot be remobilised from them to the growing tips. Calcium is required for cell elongation and cell division. Adequate Ca helps delay leaf senescence and slows down or prevents leaf and fruit fall (abscission).

DEFICIENCY SYMPTOMS

Since plants are unable to utilise Ca 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 Ca 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:

- "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

Several factors have to be considered in assessing the need to apply Ca and the form and rate at which it is best applied. These include whether the product is being applied as a soil ameliorant or as a Ca fertiliser, the solubility and price of the Ca compound, and the susceptibility of the crop to Ca deficiency.

Soil ameliorants, such as lime and gypsum, are low priced materials that are supplied and spread in bulk at high rates. They are used on:

Acid (low pH) Soils

In very acid soils Ca 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 hardness and particle size. Hard limestone that is coarser than 250 microns (0.25mm) has little value in raising soil pH, at least in the short term. Soft limes are more reactive.

Poorly Structured (Sodic) Soils

Unless the soil is also acidic ($pH_w < 6.5$), in which case lime can be used, the soil ameliorant that should be used to improve the structure of sodic soils is **Gypsum** (calcium sulfate). 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. Lime 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, and to be leached deeper into the soil. Gypsum has little or no effect on soil pH. It will not correct soil acidity.

Calcium often has to be applied in fertiliser programs during the growing season in fruit and vegetable crops that are susceptible to Ca deficiency, even on soils that are well endowed with Ca or that have been recently limed, as a preventative measure against deficiency.

Calcium Nitrate, while more costly than other Ca products, is recommended in such circumstances. Calcium nitrate has high solubility in water, so is the product of choice where a quick response to Ca is required. It can be applied in fertigation programs and/or as foliar sprays. Routine applications are required every one to two weeks during critical growth stages, e.g. periods of rapid growth and fruit filling. Deficiency should not be allowed to develop before commencing application.

Calcium nitrate may also be used as a non-acidifying nitrogen fertiliser through drip and trickle irrigation systems and under tree sprinklers.

SuPerfect (Single Superphosphate) also contains 19% Ca. SuPerfect is used to supply phosphorus (P). Its use can also contribute to meeting the calcium requirement of crops and pastures where the soil is low in calcium.

SuPerfect is comparatively high in cadmium (Cd) compared to the high analysis phosphorus fertilisers marketed by Incitec Pivot Fertilisers, e.g. DAP. Planting fertilisers that are low in Cd should be used in vegetables. It is recommended that SuPerfect not be used as the sole source of phosphorus in NPK fertiliser blends for vegetables.

Incitec Pivot Fertilisers (a business of Incitec Pivot Ltd ABN 42 004 080 264)

28 Freshwater Place

Southbank Vic 3006

Freecall 1800 009 832

www.incitecpivotfertilisers.com.au