Calcium is king

In agronomic terms, Calcium is so much more than just a nutrient. Calcium dictates plant strength, disease resistance and nutrient regulation in the plant. Calcium is known as ‘the Trucker of all minerals’ into the plant. It is critical to plant production because of its influence over the uptake and distribution of other nutrients and carbohydrate stores through plant parts.

Calcium is critical to overall crop nutrition, cell function and development and hence influences overall efficiency of plant production. A shortfall in Calcium creates costly flow-on effects, such as increased Nitrogen requirement, greater susceptibility to disease, reduced post cutting storage life, Calcium deficiency disorders and greater sensitivity to moisture stress.

Calcium gives plants strength

Humans need Calcium for strong bones, so too plants need Calcium for strong cell walls and plant ‘rigidity’. In plants, low Calcium means poor cell wall strength and leaky cell membranes resulting in a loss of integrity and production efficiency. Increased Calcium in plants results in increased pectin production. Pectins combine with polysaccharides (sugars) to bind plant cells together within cell tissue, giving cells their structural rigidity and strength. Plenty of Calcium means strong stems and roots.

Calcium deficiency symptoms include:
- Abnormally dark foliage.
- Death in the tips of new growth.
- Weakened stems.
- Premature shedding of fruiting parts.

Calcium: the first line of defence against disease

There is a strong relationship between Calcium deficiency and disease in plants. How so? Disease organisms break into plant tissue by producing enzymes (variations of pectinase) which dissolve pectin. Higher Calcium levels increase pectin concentrations and hence resistance to these destructive enzymes. It is not just a case of whether the disease, (e.g., Botrytis, Fusarium, Moniliia) is present or absent, it is the level to which the enzymes they produce are able to dissolve their way into plants, breakdown tissue and spread.

Research confirms that good plant Calcium levels reduce disease susceptibility both during the growing season and post-harvest storage. CalPac can increase Calcium concentration and pectin levels; a valuable management tool to reduce plant susceptibility to disease.

Calcium is the link between pectin levels and plant resistance to disease.
**Calcium in soil**

Why have people in agriculture applied Calcium for over 2000 years, well ahead of the green revolution? The answer is not for soil pH alone nor mineral replacement. It is about efficiency.

In soil, when Calcium as a proportion of the mineral cations exceeds approximately 60%, there are improvements in the soil’s physical properties. Flocculation, the process of binding peds together, is increased and structure and friability improved. Magnesium and Sodium (which make soils hard and dispersive) are displaced and the water holding and infiltration capacity increased.

Plant growth responds to these soil improvements; crops have reduced Nitrogen requirements, are less moisture sensitive and show improved overall strength because the efficiency of the soil-plant dynamic is better than where Calcium is low. Throughout history agriculture has thrived where Calcium in soil is plentiful, and struggled or failed where it is deficient.

**Calcium is a plant Regulator**

As it is for soil, so too in plants Calcium is more than a simple component part – it can be managed to affect plant efficiency by being a regulator of plant response to changes in environmental conditions. For example, in sodic or saline root-zones (which impede moisture flow into plant roots due to osmotic gradient), Calcium actually regulates the selectivity of nutrient uptake to reduce the impact the salts have on photosynthesis and productivity. As shown below, Calcium will positively reduce plant Sodium uptake.

This can occur because a large proportion of plant Calcium sits within the cell wall structure, whilst another portion remains exchangeable (in plasma membrane and within the vacuole) from where it is able to regulate cell function by selectivity in nutrient uptake.

**Soluble Calcium**

- **facilitates crop selectivity in nutrient uptake, reducing the impact of excess salts.**

  "After regular applications of CalPac, our irrigated lucerne has significantly improved, stems are solid, yield has increased more than 15% and we have noticed superior recovery following cuts in the heat of January. We are seeing big improvements in the crop’s ability to take in water and withstand heat stress, better than ever before. We calculate a $5 return per dollar spent, excluding lower insect pressure".

  **Angela Drury**

  "Santa Lea", Moree, NSW.

**Unlikely other nutrients, Calcium stands in reserve, ready to activate a response when there is a stress associated with moisture, salinity, nutrition or heat.**

‘Pulses’ in Calcium concentration allow plants to maintain cell elongation, cell division and cell pH during critical growth stages. Calcium will exchange with K\(^+\), Na\(^+\) or H\(^+\) to help maintain optimal plant function.

Solubility is essential. Soil Calcium is very slow to move into new plant tissue. Foliar applications of soluble Calcium via CalPac can significantly increase plant responses compared to soil applied Calcium.

**Quick Facts:**

- Foliar applied soluble Calcium has been found to increase plant absorption of ammonium by as much as 100%, improve soil nitrate extraction and increase photosynthesis.
- Calcium decreases the tendency of plants to wilt under water stressed conditions.

**Putting it all together**

- Greater plant Calcium levels positively influence the efficiency of plant production. It regulates the uptake and movement of other nutrients from the roots throughout the plant cells, particularly Nitrogen.
- Soil Calcium is very slow to translocate through plants, particularly during periods of rapid growth and cell division. Hence foliar applied soluble Calcium can overcome a shortfall quickly and cost-effectively compared to soil applications.
- Appropriate foliar or fertigation of soluble Calcium will reduce Nitrogen fertiliser needs, decrease disease susceptibility and increase mineral density in harvestable plant parts.

**Calcium, assisted by Molybdenum, is the basis of Nitrogen fixation and amino acid chemistry. Nitrogen, allied with Calcium in the form of amino acids, reacts with every other nutrient element, the most important being Magnesium, which is the basis for chlorophyll and photosynthesis. Chlorophyll traps energy and shunts it via Phosphorous into Carbon structures, which go where Potassium, the main electrolyte, carries them. Thus the biochemical sequence for plants is B, Si, Ca, Na, Mg, P, C, K.**

**Source - Hugh Lovell**

**References**