

Calcium : Magnesium and other cation ratios

Aglime Action

Number 21

Steve Carr August 2003

How important are cation ratios?

Each year, farmers are faced with new concepts or products which often claim to solve all production problems. In recent years the ratio of calcium to magnesium in soils is claimed by some to have a major effect on crop yield.

However, the overwhelming evidence shows that cation ratios:

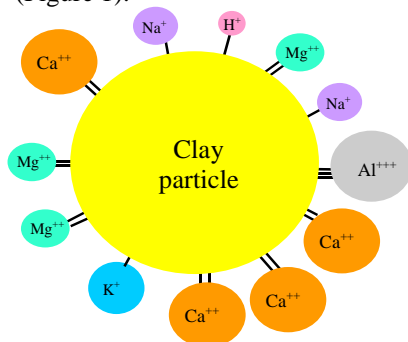
- can help in identifying soil structure problems but
- are not important in plant nutrition

What are cations?

Cations are elements with 1 or more positive charges when dissolved in soil water (eg potassium+, sodium+, calcium++, magnesium++, iron++, aluminium+++)

Clay and organic matter are covered in negative electrical charges called exchange sites.

Cations are attracted to and hold onto the negative exchange sites (Figure 1).



The amounts of different cations vary between soils.

Cations and soil structure

Soils with poor structure tend to have many more sodium cations attached to the clay (and sometimes more magnesium). This causes the clay particles to disperse when wet and set like concrete when dry.

Adding calcium in the form of gypsum (calcium sulphate) or Aglime (calcium carbonate) can improve the structure of soil. The stronger binding calcium cations displace the weaker held sodium (or magnesium) cations from the clay particles. Clay particles can then bond together to form a well structured soil.

Calcium: Gypsum or Aglime?

Gypsum is 23% and Aglime 34% calcium. Gypsum dissolves in all soils, but Aglime only dissolves completely in acid soils. If pH is under 5.0, use Aglime and solve acidity as well as soil structure problems. If pH is over 5.5 use gypsum. If pH is between 5.0 and 5.5 calculate the cheapest form of calcium and apply the appropriate mineral.

Does your soil need calcium?

There are 3 tests that can be used to assess if adding calcium is likely to improve soil structure. All 3 used together are the most effective.

1. Farmer observations:

Clay soils that are typically boggy when wet and hard when dry (often called 'Sunday country') will usually improve when calcium is applied.

2. Clay dispersion test:

- Drop a 4 to 6 mm piece of dry clay aggregate, into a glass of rain or deionised water (not tap water). If the clay is to be cultivated, wet enough clay with the water to mould it into a marble sized ball and drop in the glass.
- Don't move the glass - just watch what happens to it after an hour and then after 24 hours.
- If the soil does nothing at all in the water, a response to applied calcium is unlikely.
- If the soil slowly disperses into the water, first forming a halo of clay particles around the aggregate, it is likely the soil will respond to the addition of calcium.

- The greater the cloudiness of the water and the more rapidly it develops, the greater will be the benefit of adding calcium to the soil and the higher the amount needed.

3. Laboratory test:

Exchangeable cations should be selected for testing when soil samples are sent to the laboratory.

If ESP (exch Na%) exceeds 6, or EMP (exch Mg%) exceeds 15, it is likely the soil will benefit from application of calcium. Ideally other information about the soil (e.g organic matter and electrical conductivity) are needed to more accurately predict calcium responsiveness.

Cations and nutrition

In WA's climate and soils most plants are able to extract enough calcium and magnesium needed for optimal growth.

A possible exception can be canola, which has a high demand for calcium (Ca) in spring. The 'tipple top' observed is Ca deficiency. This is environmentally induced under warm moist conditions with very fast growth rates. The Ca needed simply can't move fast enough to new tissue even though there may be plentiful supply in the soil.

Although there have been hundreds of trials and published papers throughout the world, no research has demonstrated an optimum exchangeable cation ratio for nutrient supply to any agricultural crop.

Special points of interest:

- Electronic newsletters are now available. Email us to register steve@aglime.com.au
- Free soil pH testing and liming recommendations are a service offered to Aglime clients
- Contact David York (Precision SoilTech) to learn about our soil sampling or mapping services: dave@aglime.com.au


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