

## Treating bicarbonate affected soils

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### Background

Good soil structure is critical to healthy plant growth. Soil is a three dimensional system of solid mineral particles and organic material with pores between the particles and aggregates that control the soil's aeration, water intake, water storage and drainage.

Poor soil structure can restrict water infiltration and subsequent movement of water within the soil. It can also adversely affect aeration of the soil and plant root development. Soil structure can be impacted in many ways, for example:

**Sodicity** occurs where sodium content of the soil is high and the calcium content is low. **Alkalinity** gives rise to formation of calcium carbonate and subsequent calcium lock up. **Salinity** occurs when the salts of Na, Ca and Mg, with chloride, bicarbonate and sulphate, accumulate in the soil.

Alkalinity, sodium and salts originate from natural mineral weathering but they accumulate in high concentrations wherever water carrying dissolved salt collects, evaporates and leaves salts behind. Since the water required to irrigate one hectare of land at a depth of 30cm can contain more than 3,000kg of salts, irrigation is frequently a contributor to problems of soil structure. While reclaimed water is generally highest in total dissolved salts, bore water, canal and well water can also contain high levels of salts.

When too many salts accumulate in the root zone of a soil, a turf will not achieve optimum growth and development. This is because the presence of salts slows the movement of water within the soil and nutrient to the turf roots, inhibiting germination and stand establishment. High salt concentration also causes soil compaction that in turn restricts infiltration of water.

**EQUALise** is a soil balancer and activator by Matchplay, that was developed in response to problems associated with the high level of salts and carbonates in irrigation water (often due to the uses of sodium bicarbonate in washing detergents). Previously, acid injection was the only treatment option for soils affected by these poor quality waters. The need that was identified was for a surface applied soil drench to treat isolated surfaces (eg; greens) without having to inject and subsequently treat all irrigated surfaces.

Application of EQUALise can help to;

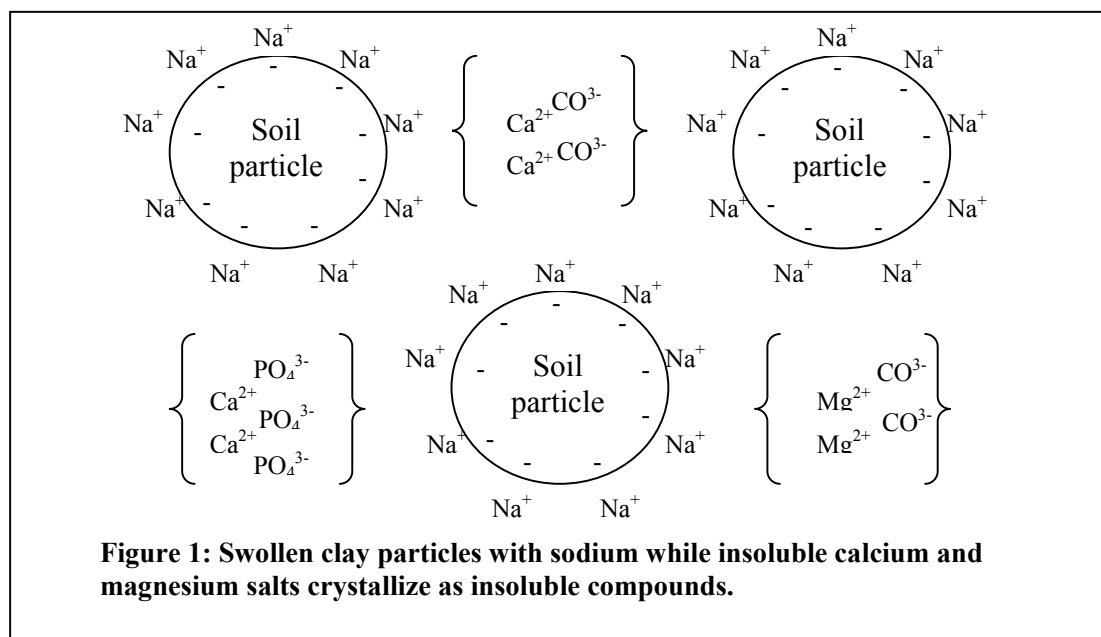
- Improve water infiltration, drainage and water retention
- Improve soil structure, aeration and nutrient availability (eg, Ca, Mg and P)
- Reduce sodicity, salinity and improve turf establishment / development.
- Increase the efficacy of fertilisers and soil applied chemicals.

Improvement in any of the above factors leads to better growth resulting in increased yields and higher quality crops.

**How does EQUALise work?** First and explanation of the problem

## High sodium affects water infiltration

The clay portion of the soil consists of stacked clay platelets that have a net negative charge. As a result of their negative charge clay platelets attract positively charged ions in the soil water, such as calcium, sodium and magnesium. As water evaporates, however, calcium and magnesium can combine with carbonate, sulphate or phosphate to form insoluble salts. When this occurs, sodium ions then dominate the clay surfaces; the soil particles swell, making it less permeable. This prevents water infiltration and salt leaching (Figure 1).



## High salt concentration affects plant growth

When the concentration of salts in the root zone of a soil reaches a threshold level, it can prevent optimum turf growth and development in two ways: osmotic effects and specific-ion toxicity.

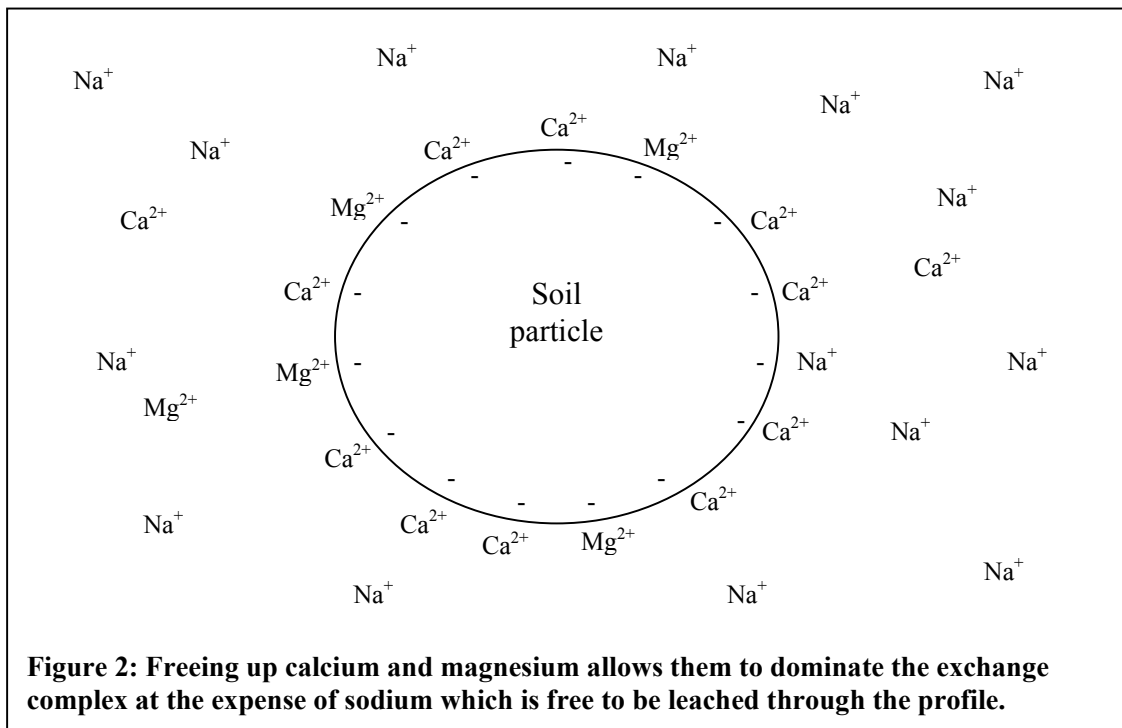
**Osmotic effects** are the most severe. As the concentration of salts in the soil water increases, it initially makes the soil water less available to the plant. To keep salts in the soil from reducing the availability of water, the plant cells must adjust osmotically which requires the plant to expend energy that could otherwise be used for growth. When salt concentrations increase further, exosmosis causes premature wilt and severe plant injury.

**Specific-ion effects** can also limit optimum growth. When chloride and sodium ions are absorbed by the roots and accumulate in the plant leaves, they can impede the nutrient uptake producing symptoms of deficiency and tissue damage. Each turf species can tolerate salts to a certain threshold, however once that is exceeded plant health declines.

## How EQUALise helps....

Water infiltration problems are currently addressed through management of irrigation water, mechanical practises to improve drainage, selection of tolerant crops and the use of traditional soil amendments like gypsum and acid based fertilisers.

EQUALise provides a new and effective treatment option that can be used in conjunction with existing methods. EQUALise has been specifically developed to increase and maintain the solubility of calcium and magnesium salts in soil. Once these have been freed, they exchange places with sodium on the soil exchange sites so preventing swelling of the clay particles and allowing excess sodium to be leached past the root zone (Figure 2). By decreasing the concentration of sodium salts in the root zone, soil water moves easier, root growth is improved and better turf stands are established.



EQUALise prevents calcium and magnesium immobilisation by acting to prevent the formation of calcium and magnesium carbonates and to alter the crystal form of any carbonate that occurs. Its mode of action is to disrupt the ion clusters that form when calcium in the soil starts to become immobilised during evaporation. One molecule of EQUALise can disrupt clusters containing multiple calcium and carbonate, sulphate or phosphate ions and once the cluster breaks up, EQUALise is freed up to repeat the action with other ion clusters that start to form. In this way a few parts per million of EQUALise can release many tens of parts per million of calcium and magnesium ions.

In addition to the beneficial impact this action has on soil structure, the action of EQUALise in effect, maintains more calcium and magnesium ions in solution by increasing their solubility limit. Practically speaking this suggests that the effect of

applied soil amendments such as gypsum can be maximised with subsequent application of EQUALise.

Being a long chain polymer of organic acid derivation, EQUALise is highly stable and will resist leaching by settling in a soil matrix and continuing to work for an extended period. Application strategy suggests two to three applications per irrigation season is sufficient to maintain availability of calcium and magnesium and resist soil degradation on soils where irrigation water contains bicarbonates.

## **Conclusion**

EQUALise gives a simple and effective way to improve soil compaction, water infiltration and nutrient availability where soils are affected by poor quality irrigation water. Improvement in these factors translates into better seed germination, turf stand growth and development and more efficient use of fertilisers and soil applied chemicals.