FLINDERS AGRICULTURE

Refined not mined alternatives to entrenched agricultural products such as Lime and gypsum with the added benefit of silica and other trace elements.

CALCIUM SILICATE

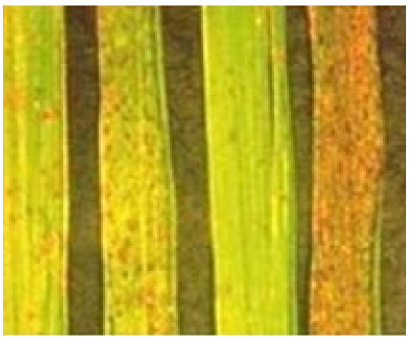
Calcium and Silicon tend to work hand-in-hand, with both elements being important cell wall materials that add both strength and stability to the plant. In plant growth, Calcium and Silicon serve to mobilise other essential elements into the plant more readily. Flinders Agriculture Calcium Silicate is a unique and ideal agricultural product as it not only contains a high percentage of water-soluble, plant-available silicon (PAS) but also contains plant-available calcium (Ca).

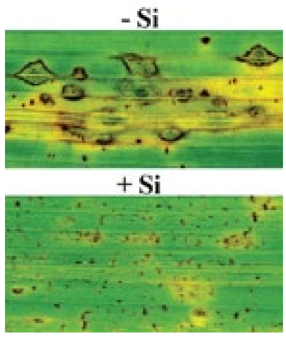
Flinders Agriculture's Calcium Silicate is a unique product unlike any other fertiliser or soil amendments on the market. It contains both a high percentage of watersoluble silicon and available calcium (Ca) to allow plant uptake. The product has been manufactured with the end-user in mind being easy to store and apply, whist also being cost effective. Best of all it is sourced from 100% sustainable and recycled materials, containing no substances that will contaminate the soil

Silicon Deficiency

With Ca and Si regularly being removed through plant growth and crop rotations, many common fertiliser inputs do not replenish these deficits adequately.

Add to this Si being "locked up" by quartz and soil clays (eg. Kaolinite) that need to be weathered over many, many years before the Si is made available to the plant, it is easy to see why silica deficiencies are common in Australian soils and need to be corrected by other measures.





Silicon deficiency shown as speckling in rice on the left and on sugarcane on the right

Silicon benefits

Silicon (Si) is currently considered a beneficial element rather than an essential one in agriculture. However, it is worth noting that in the Periodic Table, Silicon is surrounded by Boron, Carbon, Nitrogen, Oxygen, Phosphorus and Sulphur that are all classified as essential elements for both plant growth and health.

For over 150 years, plant scientists have recorded the beneficial effects of Si in enhancing plant resistance and/or tolerance to various biotic and abiotic stresses. Interestingly, Si is the only mineral element known to effectively mitigate multiple abiotic stresses including salinity, drought, flooding, freezing, high temperature, UV radiation and mineral nutrient deficiency/ toxicity stress. In recent years, Si has become more globally accepted as an agriculturally important addition. The application of Si-based fertilisers has been shown to significantly enhance plant resistance to diseases and pests, thus contributing to increased food safety, higher production with lower input costs and reduced negative impacts on environmental health.

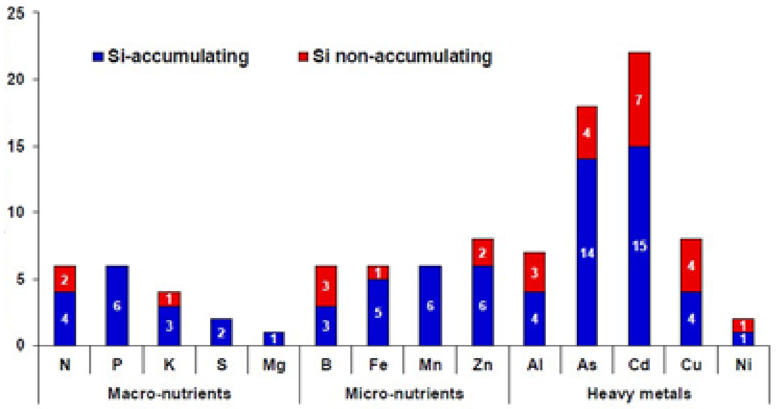
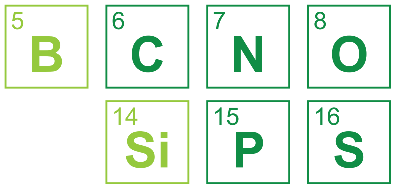
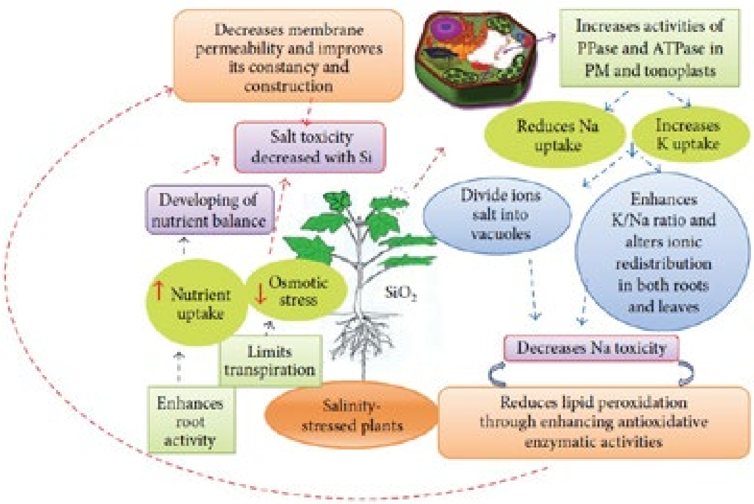


Figure 1. Number of major published articles indicating only the crosstalk between Si and nutritional stress between 2010-2020. For each element, the number inside each bar indicates the number of published articles.[19]

Silica deficiencies in the plant reduce the plants ability to resist disease and pest attack due to loss of strength and cell structure





Schematic mechanism of the interaction of Si treatment and salt stressed plants.

- Stronger, more resilient plants through the hardening of the outer cell wall [1]
- Increased stress relief protection from drought, frost and UV resistance [2,3]
- Resistance to disease organisms including fungal pathogens [4]
- Resistance to insect damage and an increased fruit wear tolerance[5,6]
- Increased fertiliser efficiency particularly nitrogen7, phosphorus[8] and potassium[9]
- Alleviates the toxicity of metal ions especially Fe, B, Al, Mn, Cd, Pb, Hg, Cu and Zn and increases the plants resistance to metal toxicities [8,10,11,12,13,14]
- Increased tolerance to water logging [15]
- Resistance to salinity stress [16,17]
- Increased shoot and root density[18]

Roles of Silicon in the mediated alleviation of salt stress

Salt stress has been the major obstacle to the successful use of salt-affected soils for crop production. It is estimated that approximately one-third of the world's land is affected by salinity, and this is growing at an alarming rate. Therefore, it is of no surprise that finding new ways to utilise saline soils has received much world-wide attention.

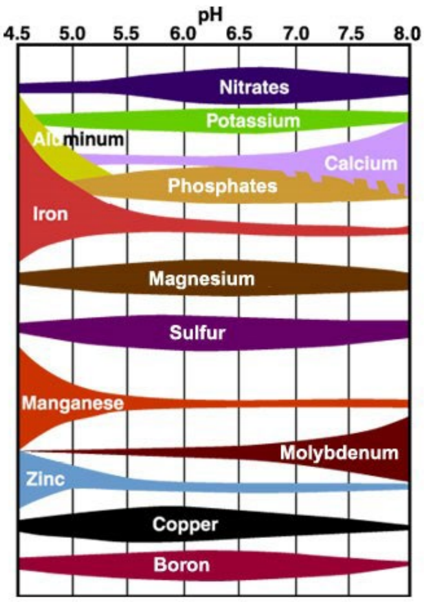
Exposure to high saline concentrations in growing mediums and irrigation water prevents the plant from absorbing the water and the required essential nutrients from the soil in three ways: osmotic stress, oxidative stress and/or ion toxicity. Osmotic stress limits water availability and absorption by the plant thus leaf water content, Carbon dioxide uptake, photosynthesis and leaf growth are all drastically diminished. Cation and anion toxicity results from salt accumulation to toxic concentrations in old leaves which leads to leaf death.

Calcum and Magnesium

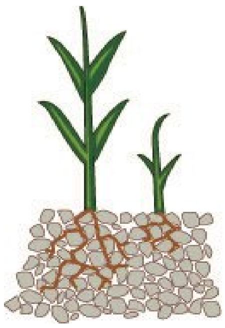
Calcium and Magnesium are major components of a soils Cation Exchange Capacity (CEC). CEC is one vital measure of soil fertility.Mineral Mulch's range of products and proprietary soil-analysis software can assist you in reaching and maintaining the desirable balance of cations for your soil type.

Within the enzyme system of the plant, Calcium is critical to the manufacture of protein. In addition, due to its unique ionic radius and its 2+ charge, Calcium has a very high flocculation power that pulls clay particles together in the soil. Flocculation is important as water, oxygen and plant roots mostly move in the large pores between clay aggregates. Calcium deficiencies lead to stunted growth, poor leaf development and paleness at leaf margins.

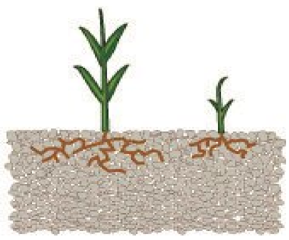
Intense cropping regimes lead to a net loss of Calcium and carbon from the soils following each harvesting cycle. This coupled with long term and/or heavy use of acidifying fertilizers, poor soil structure and heavy rainfall all lead to poor and diminished soil structure unsuitable for sustained farming. If we get the Calcium/ Magnesium balance correct, fertility will return to exhausted andbarren soils.



This diagram indicates nutrient availability at various pH levels



Soil with good structure + Ca^{2+}



Soil with poor structure - Ca^{2+}

The Mineral Mulch range is also a major source of calcium and magnesium, both essential nutrients in plant development

The Flinders Agriculture range

From our straight calcium silicate products to some of our unique soil amendment blends Mineral Mulch has the answers for almost every soil type.

	Mineral Mulch	Mulch pH Booster	EasySpread	EasySpread pH Booster	EasySpread + S	EasySpread 8020	EasySpread 8020 + S	Dolomite
Replacement for	Lime	Lime	Lime	Lime	Gypsum	Dolomite/Lime	Dolomite/Ca with no pH Neutralis-ing Value	N/A
Silicon (Si)	27%	20.3%	27%	20.3%	26.3%	21.6%	15.4%	1.58%
Neutralising Value (NV)	32%	62.25%	27%	58.5%	0%	46.2%	0%	103%
Silicon Dioxide (SiO_2)	57.75%	43.3%	57.75%	43.42%	56.3%	46.2%	44.9%	3.38%
Calcium (Ca)	14%	20.5%	14%	20.5%	13.65%	15.3%	14.98%	20.67%
Magnesium (Mg)	0.2%	0.2%	0.2%	0.2%	0.19%	2.71%	2.71%	12.75%
Sulphur (S)	0.24%	0.18%	0.24%	0.18%	2.5%	0.2%	2.5%	0.025%
Iron (Fe)	1.18%	0.96%	1.08%	0.88%	1.05%	1.06%	0.98%	0.5%
Carbon (C)	4.02%	3.02%	4.02%	3.02%	3.92%	5.69%	5.59%	
Contains other Trace Elements	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)	Yes (See full Spec sheet)
Ideal For Soil pH	**Mid to Low pH Soils**	**Very Low pH Soils**	**Mid to Low pH Soils**	**Very Low pH Soils**	**High pH Soils**	**Low pH Soils**	**High pH Soils**	**Low pH Soils**
Particle Size	98% Passing –14mm Chip	98% Passing –14mm Chip	< 75 Micron Sand	< 75 Micron Sand	< 75 Micron Sand	< 75 Micron Sand	< 75 Micron Sand	

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