

A highly economical 'refined not mined' alternative to entrenched agricultural products such as Gypsum with the added benefit of Silicon and other trace elements.

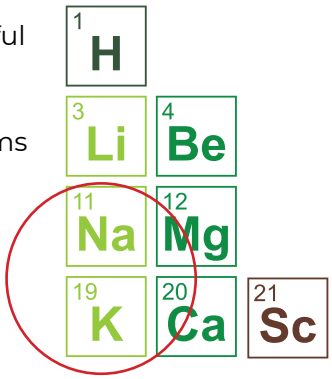
Roles of Silicate in the Mediated alleviation of Salt Stress

Salt stress has been a major obstacle to the successful use of salt affected soils for crop production. As we know exposure to high saline conditions prevent water and the essential nutrient absorption rates of plants to reduce drastically. It is estimated that about a third of the worlds land is affected by salinity and this is constantly growing at an alarming rate, therefore it is no surprise that finding new ways to utilise saline soils has received much worldwide attention.

The presence of high concentrations of salt in growing mediums and irrigation water typically stresses crops in three ways, through osmotic stress, oxidative stress and/or ion toxicity. High concentrations of salt result in osmotic stress which limits water availability and absorption by the plant thus leaf water content, carbon dioxide uptake, photosyn- thesis and leaf growth of the plant are diminished. Cation and Anion toxicity is a result of salt accumulation to toxic concentrations in old leaves which accelerates the deterioration of older leaves and leads to leaf death.

The main roles of Si in the alleviation of salt stresses in crops include:

- ✓ Improvement of plant growth. Si significantly increases the cell wall extensibility and results in an increase in root and shoot growth under salt stress, in turn it contributes to salt dilution into the plant and mitigates salt toxicity effects.[4]
- ✓ Enhancement of enzymes and catalase, preventing membrane oxidative damage.[2,3]
- ✓ Silicon deposited in the apoplast can enhance water retention by inhibiting water evaporation loss, thus reducing salt-induced osmotic stress,[1]
- ✓ Si enhances water storage, water balance and root water uptake within the plant tissues thereby reducing the Sodium (Na) ion content.[5]
- ✓ Reduces water evaporation through disposition in the cell walls of leaves, roots and shoots leading to decreases in Sodium (Na) uptake and reduced evaporation.[6]
- ✓ The detoxification of harmful oxygen species by the stimulation of antioxidant and non-antioxidant systems in plants.
- ✓ Improvement of photosynthesis and/or chlorophyll fluorescence under salt stress.[9]



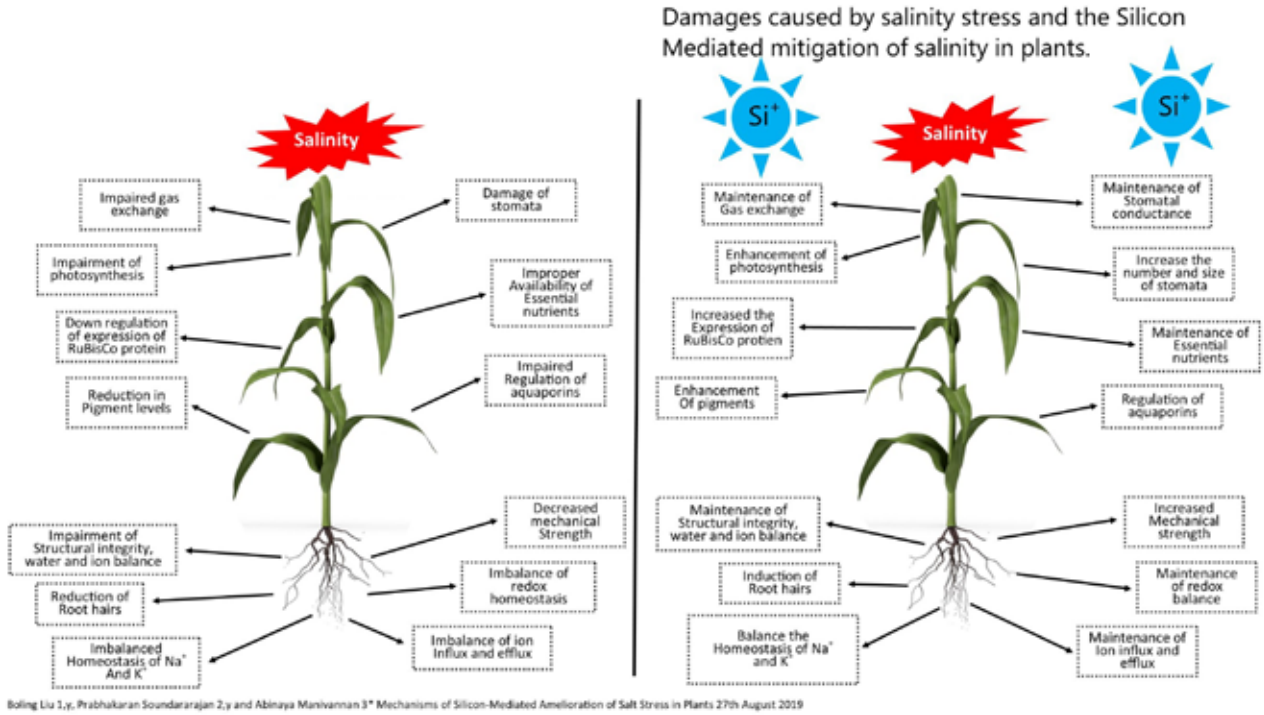
The relationship between potassium and sodium in blocking sodium uptake

Silicon hinders the uptake of Sodium (Na) but increases the accumulation of Potassium (K)[8] contributing significantly to the Si enhancement of salt tolerance because Na+ is so similar to K+ many K+ nutrient transporters do not discriminate sufficiently between these cations, excess external Na+ can not only impair K+ acquisition but also lead to accumulation of Na+ in plant cells. To help relieve this issue we must ensure that the K levels always remain higher than the Na levels. Recommended K/Na ratios vary depending on the soil type and usually sit between 1.7-2.7

In order to counteract the effect of excessive sodium on the exchange complex and to reinitiate the process of soil aggregation, calcium needs to be reintroduced into soil solution.

This is best achieved by the application of calcium (Ca) and Sulphur (S) which in turn displaces sodium (Na) on the exchange site. which reduces deflocculation and allows natural aggregation of particles that eventually, restore good soil structure.

In turn, the sodium reacts with sulfate (SO_4^{2-}) to form sodium sulfate (Na_2SO_4), which is a highly water soluble material that is leached from the soil. *This only happens if it has somewhere to leach to (i.e. free draining and dispersive soils, and soils where there is no saline water pooling around the root system and a free draining sub soil) otherwise it can have a detrimental effect e.g. sodium sulphate congregating around the root system will result in even higher sodium uptake and basically bath the root system in a sodium soup.*



Boling Liu 1,y, Prabhakaran Soundararajan 2,y and Abinaya Manivannan 3* Mechanisms of Silicon-Mediated Amelioration of Salt Stress in Plants 27th August 2019

Our Calcium Silicate products are unique, as they not only contain up to 27% Si and 14% plant available Ca and a host of essential trace elements, including Iron, Copper, Zinc, Boron and Manganese. And our Easyspread + S product contains elemental Sulphur allowing us to tackle the Sodium issue from yet another angle. We can also Custom Blend these products to add more Sulphur if it is required. Best of all they are sourced from 100% sustainable and recycled materials, containing no substances that will contaminate the soil.

References

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