

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

Silicate in The Mitigation of Heavy Metal Stresses

Over the past few decades, heavy metal contamination of agricultural soils and water has increased mainly due to atmospheric and input pollutants. The higher exposure of crop plants to heavy metal stress and toxic levels of trace elements reduces growth and yield that affect the sustainability of agricultural production. Numerous studies have reported the beneficial role of Si in mitigating stresses imposed by biotic as well as abiotic factors including heavy metal stress.

Although naturally present in the soil the concentration of heavy metals increases as a result of geologic and anthropogenic activities. Heavy metals retard plant growth by marginalizing the cellular functions of proteins, lipids, and elemental components of thylakoid membranes. Heavy metals can be transported through the food chain into animals and humans, so their presence can cause a significant threat to human and animal health.

Silicon, the second most abundant element after oxygen in the earth crust, is considered as a quasi-essential element due to of the numerous benefits it confers to plants, specifically under biotic and abiotic stress. For instance, it is reported to alleviate a number of abiotic factors in plants including drought, salinity stress, strengthening of the cell structure, lodging and heavy metal toxicity. Despite the abundant availability of Si in soils, the plant-available form is often limited. Inorganic materials such as quartz, clays, micas, and feldspars, although rich in Silicon, are poor silicon-fertiliser sources because of the low solubility of the element in this form.

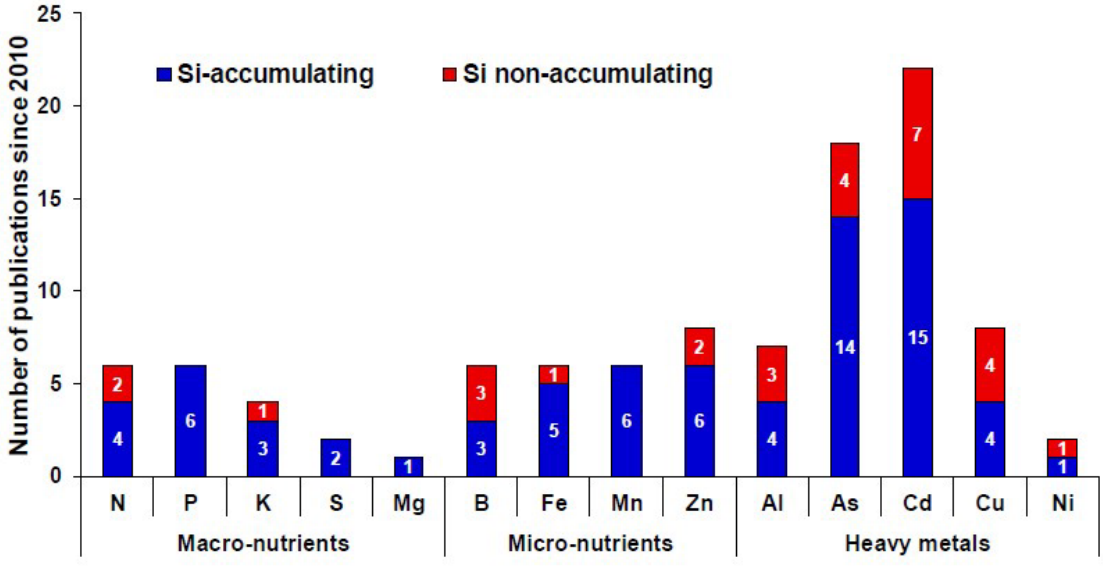


Figure 1. Number of major published articles indicating only the cross-talk between Si and nutritional stress between 2010-2020. For each element, the number inside each bar indicates the number of published articles.

Nusrat Ali , Elise Réthoré, Jean-Claude Yvin and Seyed Abdollah Hosseini. The Regulatory Role of Silicon in Mitigating Plant Nutritional Stresses Published: 15 December 2020

'The beneficial effects of Si are predominantly if not exclusively manifested when plants are subjected to stress'

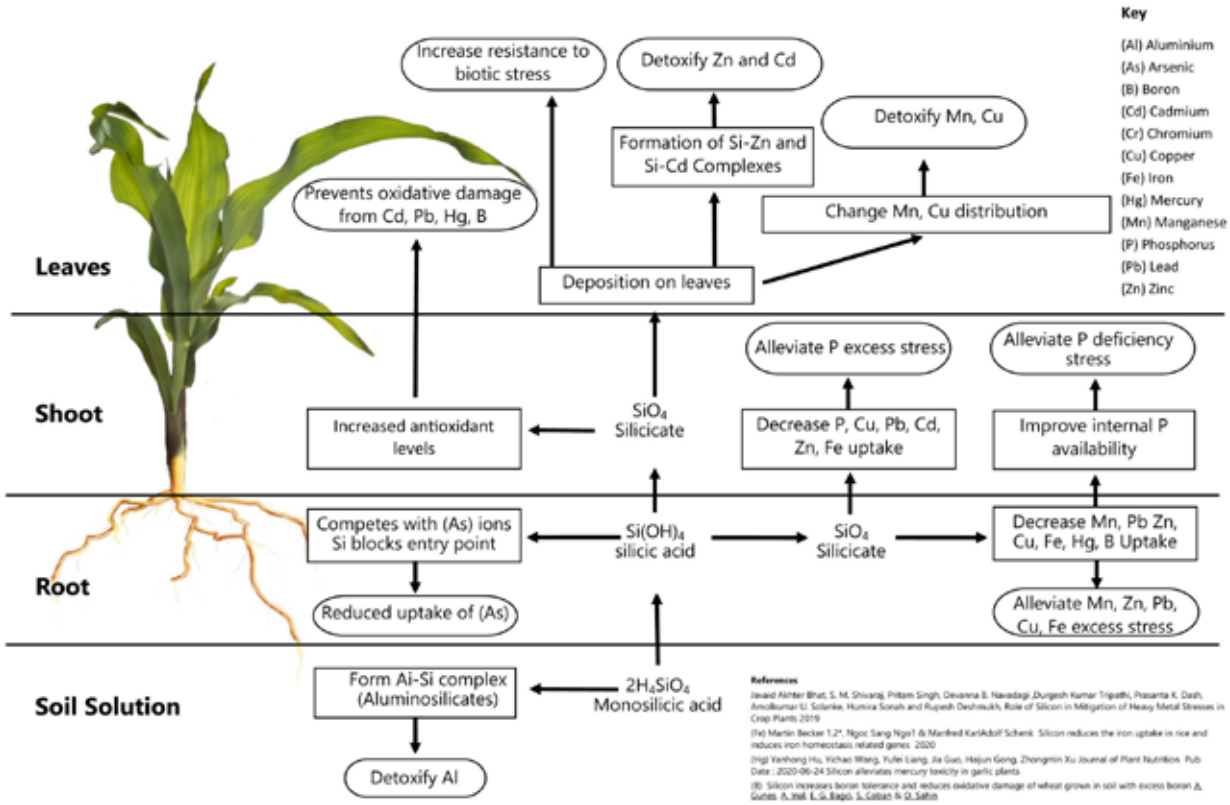
Micronutrients from essential to toxic

The term heavy metal refers to any metallic element with relatively high density that is toxic even at low concentration. In general, heavy metals relate to a group of metals and metalloids with greater than 4 g cm-3 atomic density.

Heavy metals are classified into non-essential elements (Cd, Pb, Hg, Cr, As and Ag) being potentially toxic to plants and essential micronutrients (Cu, Zn, Fe, Mn, Mo, Ni, and Co) which are important for healthy growth and the development of plants. The essential heavy metals are involved in many important biochemical and physiological processes of plants. The principal functions of essential heavy metals include participation in the redox reaction of cellular processes. In general, a plant grows normally as long as the supply of a given nutrient matches the plants requirement

A deficiency of nutrients will result in symptoms leading as far as mortality in some conditions. The presence of both **essential and non-essential** heavy metals in excess can lead to the reduction and inhibition of growth in plants, caused by biochemical, structural and physiological changes. Higher concentrations of heavy metals also alter the uptake, accumulation, and translocation of the essential elements in plants. Common toxic effects of heavy metals include inhibition of growth and photosynthesis, chlorosis, low biomass accumulation, altered nutrient assimilation, water balance and senescence, which ultimately can cause plant death.

Mediated mechanisms for enhancing tolerance of plants against heavy metals toxicity



Mono-silicic acid is the only silicon form that is absorbed by the plant roots but it requires adequate Calcium to be present to move the silicon into the epidermal (outer) tissues and create a Si-cellulose membrane. This in turn makes Flinders Agriculture's Calcium Silicate with its provided 4 forms of highly available Calcium, Calcium Carbonate (Lime), Calcium Oxide, Calcium Silicate and Calcium Sulphate (Gypsum) an ideal agricultural silicon and Calcium source. Our products have been manufactured with the end user in mind being both easy to store and apply, whilst also being a cost-effective input. Best of all, it is sourced from 100% sustainable and recycled materials, containing no substances that will contaminate the soil.

FLINDERS AGRICULTURE
ph: 1300 895 988
e: info@flindersagriculture.com