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While silicon is one of the most common elements in the earths crust, its role in the nutrition of plants is relatively poorly understood.
Research results in North Queensland's sugar cane belt are indicating that it is an important plant nutrient, and that it may be present in sub-optimal levels on several different soil types.
We do know that sugarcane can take up more silicon than any other nutrient and it is one of the few crops in which silicon responses have been documented world wide.
Silicon is reported to enhance the health of the sugar cane plant in a variety of ways. Adequate silicon nutrition may help protect plants from insect and fungal diseases and prevent micronutrient toxicities and other nutrient imbalances.
Silicon is also known to improve water use efficiency and enhance root growth and structural strength. In addition to playing an important role in cane growth, other silicon compounds present within the soil solution impact on soil physical and chemical properties such as soil aggregation, water holding capacity and exchange and buffering capacity.
As such, all forms of soil Si have an important role in the productivity of soils.
With funding from the SRDC and in collaboration with CSIRO Land and Water, BSES, Sugar Yield Decline Joint Venture and the Mossman Cane Productivity Board, a three year program was launched to investigate the role of silicon in sugar productivity. In order to asses the extent of sub-optimal soil Si levels, an initial soil survey exercise was undertaken.
The regions surveyed included the Atherton Tablelands, Mulgrave, South Johnstone, Babinda, Mourilyan, Mossman and Tully.
More than 85% of the soils tested had sub-optimal or marginal soil silicon levels. With the exception of the Atherton Tablelands, more than 50% had levels of plant available silicon that could be considered sub-optimal (less than 10mg/kg Si).
Silicon application experiments were established in the Mossman, Innisfail and Bundaberg districts on a range of different soil types exhibiting sub-optimal levels of available Si.
At all of the sites, Ca-silicate slag (imported from the USA) was tested at different rates of up to 12 T/ha. Significant responses were achieved in the plant cane crop at all sites.
The greatest response was measured at Mossman, where at the highest rate of Ca-silicate produced a 58% increase in yield when compared to treatment receiving no silicon additions.
These initial responses were carried into the first ratoon crop, resulting in a net increase of greater than 50% over the 2 consecutive years.
In addition, different locally available silicon sources including mill ash, mud ash, Ca-silicate, cement, cement building board by-products and rock dust were tested.
At Mossman, Ca-silicate and cement resulted in significant yield increases over the control while mud ash at a rate of 50 T/ha (dry weight) resulted in significant increases in yield over the control at the Bundaberg site.
The ratoon crop has been harvested at Mossman, and again the greatest responses have been recorded with Ca-silicate, cement and mill ash treatments, where yield responses of between 35% and 49% have been achieved over the 2 consecutive years.
Whilst there are several potential silicon sources that could be used to supply plant available Si, our studies to date have only focused on easily accessible products that were available at the time.
Before recommendations can be made on products, comprehensive field testing should be undertaken on a range of soils showing sub-optimal Si levels.
There is a need for continued research into identifying soils that will respond to Si additions because although some soils may show sub-optimal levels of plant available Si, there are other soil properties that will influence the degree of response.