
Technical Case Study – Ref 5.1.2a

Observations and results on sugarcane in Mkuze

A RainBox was installed on a sugarcane farm, Mkuze, in March 2015. The objectives were:

- to monitor changes in root development and physiological growth patterns in 10-year-old sugarcane
- to show differences between treated and untreated sugarcane lands

Through the treatment of irrigation water, Agriwater offers a proven, reliable and the most cost effective way to continuously optimise water quality, clean and maintain irrigation systems and aerate soil in the global agricultural industry today. For this reason and given many other documented studies on various crops, the results were eagerly anticipated. An independent consultant Eco-Agri was also appointed to monitor all aspects of soil fertility, soil health, plant health and production and can be seen on Agriwater Case Study Ref 5.1.2b.

Soil and water conditions

The soils were predominantly Hutton types, with Brookside Soil Fertility tests (S007) showing organic matter contents of 4–5%, calcium (Ca) base saturation of 40–50%, magnesium (Mg) base saturation of 30–35% and sodium (Na) base cation saturation of 3–7%. The low Ca:Mg ratios and high levels of Mg were a challenge in these soils. Water tested over the periods from July to October could be classified as C2S2 to C3S2 with medium salinity and sodium hazards. The water quality was reflected in the soil chemical status and condition.

Two profile holes were dug in the treated and untreated lands in February and April 2016 and the following observations were made:

Root development

In the treated lands, root development was measured up to 1200 mm, the same depth of the profile hole. Good uniform distribution of healthy hair roots was clearly visible.

In the untreated land, root development could only be measured up to a depth of 400 mm and there was also little visible evidence of healthy hair roots.

Soil structure

The treated soil profile was well structured and aerated, with good aggregate stability and friability. These play an important role regarding water holding capacity and root development.

The untreated soil profile was hard and compacted, with Mg concretions clearly visible. The higher levels of Mg would have affected water availability and negatively root development.

Both soil profiles were wet throughout with ideal soil moisture contents.

Plant physiology

The treated sugarcane had uniform internodes of about 20–25 cm in length.

It can thus be determined that:

- plant growth was never really under stress
- higher temperatures and dry conditions had no negative effect on the sugarcane
- the better soil conditions buffered prevailing high temperatures and possible water stress conditions and stimulated root development, thus improving water and mineral uptake

In comparison, the untreated lands had both variable and shorter internode lengths of 5–7 cm (see photo below).

It can thus be determined that:

- stress conditions caused shorter and variable internode lengths
- water stress, high temperatures and dry circumstances were responsible for the shorter internodes
- in this environmentally stressful situation, the poorer soil conditions negatively affected water infiltration, water holding capacity and root development

Photo of treated and untreated sugarcane

(Above = treated & Below = untreated)



High levels of Mg in soil hold water tightly on the clay platelets, reduce soil pore spaces, increase compaction and can restrict oxygen and water uptake by the plant. Plants must then use more energy for water uptake and physiological processes. The practical result of this is the development of shorter and uneven internode lengths as seen on the untreated lands. Conversely, given the longer and even internodes of the treated lands, the implication is that the higher levels of Mg did not negatively affect plant growth on the treated lands.

The treated sugarcane also had darker leaves indicating better photosynthetic activity and overall, that plant growth was better. Leaf analysis after Agriwater treatment showed that treated leaf Mg concentrations were almost double the untreated leaf Mg concentrations. It is speculated that Agriwater treatment converted the unavailable Mg (carbonate form) in the soil to plant-available sulphate forms. Mg is one of the cardinal elements involved in chlorophyll synthesis and therefore resulted in the darker green colour of the treated sugarcane.

Both lands had excellent production potential which made comparisons in yield difficult. The treated lands also had the water switched off earlier given the improved water holding capacity of the soils and the excellent growth. At harvest, the untreated lands were physiologically ripe, but the treated lands were not yet ripe.

The production advantage will be even clearer in the next ratoon, because:

1. The treated land had at least double the root growth and distribution of the untreated lands.
2. Sucrose stored in the roots would be used to initiate and advance quicker and uniform plant growth.
3. Better soil structure and aeration should lead to further improved water infiltration and holding capacity.
4. Better root development would buffer the plants against adverse environmental conditions, inducing water shortages and high temperatures and thus, reduce production risks.
5. Savings will be apparent in irrigation costs and water usage due to the improved soil structure, water holding capacity and better use of water by a larger volume of roots.

Better results will be achieved if water management is adjusted to match the improvements in water infiltration and holding capacity.

Video-material

Click on the links below to access **YouTube** videos – an internet connection will be required.

Differences in growth:

<https://youtu.be/WTtoLx3yH6k>

This video shows the differences in growth, colour and internodes of treated versus untreated sugarcane.

Profile pits

Untreated:

https://youtu.be/cMJM_9NLuyk

Treated:

<https://youtu.be/n0WOJbPf00U>

Profile pits of treated and untreated lands clearly show the differences in root development and plant growth.

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