
Technical Case Study – Ref 5.1.9

Growing crops with saline water from a salt pan after installation of a RainBox

Palmietfontein farm is situated in the Luckhoff area, Northern Cape. Underground water from all the higher situated pivot lands drained out into a wetland, which when dry was like a salt pan and covered in a thick layer of various salts. However, given the amount of water that would rise up in the wetland, Mr C du Toit decided in 2011 to utilise the water. The idea was to dig a little dam, collect the water and pump it onto a land for irrigation purposes. The dam was probably around 20 m in diameter, about 4–5 m deep and stayed perpetually full once completed.

Given the saline water risk, a 3.8 hectare pivot was allocated for the water, maize was planted and all farming practices were as normal. Within a short while poor uniformity was seen in the maize and tonnages did not exceed 6 ton/ha. It was noticed that the soils also became very hard when dry and salts deposits could be seen on the soil surface. It was very difficult even to dig a hole in the soil with a spade.

Salts on the surface of the salt pan around the dam can be seen below:



The maize was moderately tolerant to chloride leaf application, but moderately sensitive to chloride and salts in the soil and the poor yields indicated that a more tolerant crop was required. Therefore, Mr C du Toit and his son Kosie decided to plant lucerne on this pivot. Blockages in the nozzles and sediment build-up in the pipes were now becoming very apparent.

The lucerne struggled to grow and in early 2012 they decided to install a Agriwater 0.5 Unit on this dam to see if it would be able to optimise the water quality, improve the soils and enable better yields of the lucerne. Within a short while of installation, visible improvements were seen with the lucerne and the soils became loose and aerated once again. Penetrometer readings now reached 30–40 cm, while previously it would not penetrate more than 5–10 cm.

The RainBox next to the dam:



Furthermore, after installation the yields were now 80–85% of standard lucerne yields in the area and averaged 2,1ton/ha/cut versus the standard of 2,5ton/ha/cut. The total cuts per year was the same as the regional standard and growth was similar with cuts every 5–6 weeks.

Along with the improvements in soil structure and crop growth, some mineral micro-nutrient deficiencies started to appear – as expected with this quality of water and its effects on the soils. These were rectified with foliar sprays and the lucerne continued to grow adequately.

It was also notable that salt build-up and blockages in the pipes and nozzles were eliminated since installation of the RainBox and have never occurred again.

Results of water analysed on 7 July 2014 by Bemlab:

Source	Lab. No.	pH	EC mS/m	OP kPa	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Fe mg/l	Mn mg/l	Cl mg/l	CO ₃ mg/l	HCO ₃ mg/l	SO ₄ mg/l	B mg/l	Adj. NAV
Palmietfontein	5988	8.3	80.6	29.02	164.0	0.6	18.7	23.3	0.03	0.00	44.1	27.1	401.9	64	0.93	6.47 H

The water was classified as a C3S2 type with sodium (Na) being a major contributor to the soil aeration problems. *Basically a C3 type water was regarded as saline and not recommended for use on soils with limited drainage. Similarly the S2 indicated a medium sodium water, which could cause problems on finely textured soils, unless gypsum was routinely applied.* Notable here was that the target pivot had grey soils with limited drainage and were finely textured high clay soils. Given the quality of water, these soils were not really ideal for use and all the expected problems occurred.

Also notable was the imbalance of calcium (Ca) and magnesium (Mg) in the water sample – the levels of Mg were higher than the Ca. Over time these levels of Na, Ca, Mg and Na in the water would be visible in soil tests as low Ca:Mg ratios, high % Na and % Mg, low % Ca, and further add to nutrient unavailability and compaction problems.

The EC of this sample was high at 80.6 mS/m, a major contributor probably being the Na, which was high at 164 mg/l. The effects of the high EC and associated salts could be seen in the soil. A conservative amount of irrigation water at 5 000 m³/annum would be equal to some 2.5 tons of salts applied per hectare and would require gypsum or other amendments. Similarly the pH and associated bicarbonates (HCO₃) were also high.

The positive Langelier index at 1.04, although not high, showed a tendency for calcium carbonate deposits to form on pipes and nozzles. These deposits were eliminated from the pipes and nozzles after installation of the RainBox, thus providing evidence of how the Agriwater Advanced Oxidation Process (AOP) works in saline waters.

In spite of all the potential problems of using this relatively saline water on these problematic soils, decreasing crop growth and yields with maize and lucerne, sediment build-up in pipes and nozzles – use of the Agriwater Water Treatment Technology changed the picture back to an almost normal situation with aerated soils, good yields and a clean irrigation system.



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