

Technical Case Study – Ref 5.1.5

Observations recorded on Citrus in Patensie, over the 2013/2014/2015 citrus seasons

Various RainBoxes were installed on a citrus farm in Patensie during June 2013. Effects in soil, water use efficiency and crops were monitored by their local fertiliser/irrigation consultant.

The orchards treated by the RainBoxes included 8 to >15-year-old Navels, Midnights, Novas, Clementines and lemons.

Soil history and orchard challenges

The soils on this farm were mostly deep Hutton types, but it always had compaction problems. Penetrometers would not penetrate deeper than 20–30 cm and that with difficulty. The soils had a pH of 7.4 to 7.6 with various inherent soil salinity problems.



The orchards always showed signs of iron (Fe) deficiencies – with severe iron chlorosis of the leaves. Although foliar applications of the best Fe-containing products were applied, this was a continual challenge. (Date of photo 22/07/2013)

Given soil compaction problems, it was always difficult to get enough water down the whole soil profile and irrigation management was critical for optimal mineral uptake and production. Soil amendments had been in place for years to reduce the effects of soil salinity but the improvements were slow. No costeffective treatment was available to improve water infiltration and reduce compaction.

Agriwater monitoring since installation in 2013

Standard optimal fertilisation, irrigation and spray programs were kept the same in the treated orchards. Nothing special was done in these orchards, which could be attributed to some of the changes observed later.

All aspects of irrigation scheduling were closely monitored by the local independent consultant. The standard water scheduling program included use of Class A pan, rainfall information, soil probe water profile data collection and analysis, and weekly orchard checks with a soil auger up to 80 cm in depth. Assimilating of all this information enabled the consultant to accurately measure and recommend any changes in water use requirements in each orchard.

Over the 2014 to 2015 seasons, the following changes were noted by the independent consultant and irrigation advice amended accordingly:

FACTORS MEASURED	What were the results?	
	2013 – before installation	2014/2015
1. Drippers and pipes were checked for blockages. 2. Soil compaction was measured with a penetrometer. 3. All aspects of irrigation scheduling as above were closely monitored.	1. Drippers and pipes were always blocked and required weekly maintenance. 2. Penetrometers would not penetrate deeper than 20–30 cm and that with difficulty. 3. The average volume of water required to wet the profile down to 60 cm was 276–300ℓ/tree/week before installation.	1. The drippers and pipes were kept clean. 2. Penetrometers now reached 40–60 cm in depth with relative ease. 3. The average volume of water required to wet the profile down to 60 cm was now an average of 165–180ℓ/tree/week by November 2014. • In other words some 40% less water was required. • Water use efficiency showed substantial improvement. Weekly water requirements per tree were reduced across the board – for each given season.

As per water scheduling calculations and advice given – later readings showed even further reductions per tree/week into and through the hot dry season of January/February 2015. So the 40% reduction in water use was maintained and even reduced further through the hot season.

As observed, these improvements in water use efficiency could be attributed to improved soil aeration and infiltration rates, better root systems, evidence of more earthworms, improved soil structure and improved water holding capacity.

Clean irrigation systems, reduced compaction and substantial improvements in water use efficiency, as well as the following other factors were also observed by the consultant:

- The Iron chlorosis leaf symptoms disappeared.
- The leaves of the trees no longer curled up in the heat, but stayed open.
- Root depth of active fibrous roots as measured in soil profile pits increased by 10–20 cm. This represents a substantial expansion in fibrous root depth and volume. Likewise, average depth of pioneer or lateral roots in soil profile pits increased by 30–60 cm. Given average previous pioneer root depths of some 60 cm, the improvements represented an average $\pm$ 75% improvement in root depth.
- Where the orchards previously were not uniform in height, colour or appearance, they were now very even and uniform in all respects. The differences were visually notable.

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