

SECTION 5
WATER MATTERS

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Sub-surface drip improving soil (and water)

Stewart Crawford farms near Narromine in the Macquarie Valley and has been one of the pioneers of sub-surface drip irrigation in broad-acre crops. He has been using sub-surface drip to grow irrigated cotton and grain crops such as corn, sorghum and wheat for nine years.



Stewart Crawford, who farms on Quondong, Narromine, is an Australian pioneer of sub-surface drip irrigation in broadacre crops.

The soils on his farm are sandy loam, drain freely and have a fragile surface structure. Stewart has undertaken significant work to improve the soil structure with minimum tillage and the application of gypsum/lime.

Why act?

Stewart believed too much water was being lost below the root zone as deep drainage with surface irrigation. He decided to investigate drip irrigation as a crop management system to reduce the amount of water lost as deep drainage.

A critical aim was to increase yields with the judicious use of water. If yields could not be increased using drip then a drip system would never pay for itself. As there were very few drip irrigation systems in broadacre crops in Australia a decade ago, Stewart visited the US on a study tour to look at drip irrigation systems as a means of reducing water losses on his farm.

The Solution

Stewart installed his first 50 hectares of sub-surface drip tape nine years ago and now has 175 hectares (432 acres) of drip irrigation.

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<70...DRIP IMPROVING SOIL (AND WATER)

Crop nutrition

One of the significant benefits of drip irrigation is crop nutrient management. Nutrients can be applied using fertigation techniques at very precise rates on a daily or weekly basis.

Typically, Stewart applies most of the crop's phosphorus needs at planting, along with about 25 per cent of the nitrogen requirements.

The remainder of the nitrogen is applied through the irrigation water as urea, as well as anything else needed such as potassium and boron.

Crop water use

The most challenging period with drip irrigation is wetting the soil prior to, or just after, planting.

This can require up to two megalitres per hectare, depending on how dry the soil is. Pre-watering is very time consuming and is usually started three weeks before planting.

Stewart likes to keep a large area around the drip tape wet. This is good for peace of mind should there be a breakdown, as at least there are a few days of water stored in the soil profile. It also provides high yielding crops with plenty of wet soil to explore for moisture and helps to keep roots out of the drip tape.

Soil health

Stewart believes the soil has improved with drip irrigation. One of the main benefits is that irriga-

tion water is not run over the top of the soil surface, which helps the soil tilth and surface structure.

Managing crop residues has been one of the keys to success but also a real challenge. High yielding crops produce plenty of stubble, which needs to be managed. Cotton and corn stubble is moved toward the centre of the bed and sits on top of the sub-surface drip irrigation tape. So soil organic matter levels have been increasing, as all the dry matter is kept in the system. High yielding crops produce plenty of organic matter, which improves soil structure and protects the soil surface.

The Future

Looking towards the future, any new sub-surface drip installations will have a one metre tape spacing. This makes it easier to wet the soil upwards and has a better fit with winter grain crops.

**STEWART'S MUST-DO'S
FOR EFFECTIVE SUB-SURFACE DRIP IRRIGATION**

- Good design is critical to ensure enough water can be delivered to the crops.
- Make sure all valves are run at correct pressure.
- Design the system for more pressure rather than just enough pressure. One day you will need it and pressure is your best friend when it comes to drip irrigation.
- The biggest cost is energy associated with pumping the water. Budget accordingly.
- Be wary of long run lengths for high yielding crops. I don't like driving all over my county with grain chaser bins and cotton boll buggies during harvest. We want to keep out of the fields as much as possible to protect our soil structure. It is not easy to repair wheel track damage in drip irrigation fields, so we are pedantic about avoiding wheel track compaction.
- High emission uniformity across the system and sub-mains is critical. This will determine the correct run length.
- The soil structure must be in good order before installing drip irrigation. It also must be kept in good condition by incorporating trash and practicing minimum tillage.
- Drip irrigation is just like running a swimming pool. To succeed keep it clean, back wash it, flush it once per week and you won't have any problems. Use chlorine and acid when needed.
- The sub-surface drip tape depth is critical. Six to eight inches is ideal in red soils. If the tape is too deep, subbing water upwards towards seeds can be problematic. In black soils the tape can be deeper: 10 to 12 inches.
- My earlier irrigation designs had a drip tape in the middle of the two-metre beds. The newer installations have drip tapes one metre apart, which is better for subbing water upwards and for winter crops row spacings.

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