Detecting Deep Drainage at Biloela

A common problem encountered when irrigating light textured soils is deep drainage. This problem is often undetected and the soil water content must be measured at a number of depths over short time periods before the problem can be properly addressed. This application note outlines an example where a consultant measured soil water content at very short time intervals to investigate a farmers deep drainage problem.

The farmer grows cotton at Biloela in Central Queensland on alluvial soils and water is applied by furrow irrigation. However it was taking too long for water to run the length of the field down the furrows. Deep drainage was suspected and the neutron probe was used to investigate. A site was installed at the head ditch end of a field and a reading taken before the irrigation commenced, see Figure 1. Readings were taken every hour after irrigation of the site commenced and the results are shown in Figure 1.

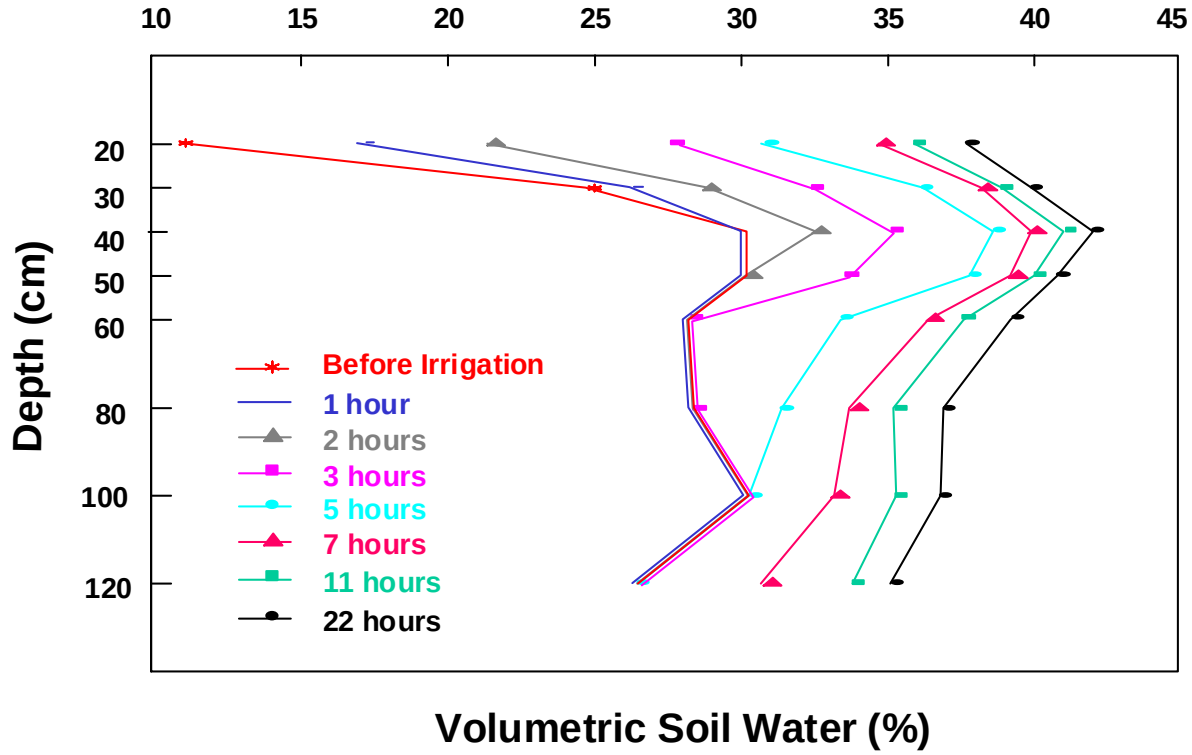

Figure 1. Deep Drainage of Irrigation Water.

After three hours water had reached the 50cm depth in the soil profile and 56mm of water had been added to the 0-70cm profile. After five hours the water had reached the 80cm depth. The normal root zone of cotton is 0-70cm, so some of this water was beyond the crop's normal root extraction and had been lost to deep drainage. At this point 89mm had been added to the profile, 83mm in the 0-70cm profile, and 6mm below the 0-70cm profile.

After seven hours the soil water content had increased at all depths. In the 0-70cm profile 102mm had been added and below this 26mm had been added. A large quantity of water was going well

beyond the crops usual root zone and was being lost via deep drainage. After eleven hours 110mm of water had been added to the 0-70cm profile and 39mm to the deeper layers. After twenty-two hours 119mm had been added to 0-70cm and 48mm of water had been added to the 70-130cm profile and lost to deep drainage.

The rate water advanced down the row was very slow travelling 80 metres in 22 hours. As there was little difference in water content between eleven and twenty-two hours, a virtual steady rate of deep drainage would have been in progress during this period. If measurements had been taken to much deeper depths we would have measured a large amount of water that had moved past 120cm. Measurements taken over the following 2-3 days would have shown that once the irrigation had ceased drainage from the saturated surface layers would have continued, losing even more water.

Deep drainage is a serious problem with furrow irrigation on this alluvial soil. Large amounts of water can be lost to deep drainage. To minimise losses runs need to be short with a relatively steep slope and water needs to be put on in large volumes to push water down the rows as quickly as possible to minimise downward movement. The data shows that the ideal time to get from head ditch to tail drain is five hours.

Not only is water a problem but also fertiliser, especially nitrogen. Nitrogen fertiliser is often put on pre sowing and is subject to a number of leaching events from irrigations before the plant has had a chance to utilise it. This has led to poor fertiliser responses on these soils. Better timing of applications and minimisation of deep drainage will ensure better utilisation of fertilisers and ensure a good yield response.

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