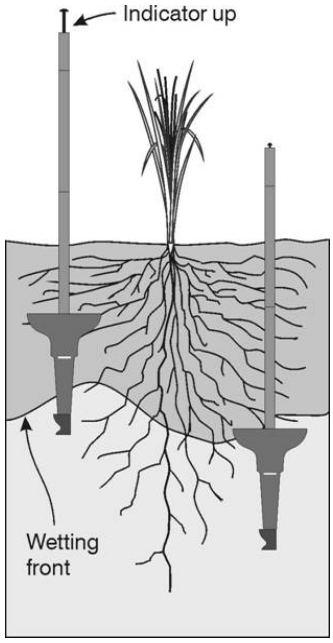
Using Wetting Front Detectors in Furrow Irrigation

The Wetting Front Detector (WFD) is a new tool to help measure how deeply water has penetrated into the soil after an irrigation event. The WFD also captures and stores a soil water sample, which can be analysed for its salt or nutrient content.

The first commercial version of the Wetting Front Detector (WFD), called the FullStop, was released in 2004. The FullStop WFD is comprised of a funnel, a filter and a float mechanism. The funnel 'captures' some water from the wetting front as it goes past, and pops up an indicator flag at the soil surface.

If the soil is dry before irrigation, the wetting front will not penetrate deeply, because the dry soil absorbs much of the infiltrating water. A long irrigation would be needed to activate a detector. However, if the soil is relatively wet before irrigation, the wetting front moves more deeply into the soil. Experiments with sprinkler irrigation have confirmed this.

The key to getting the best results from a FullStop WFD is to place them at the right depths. FullStop WFDs are rarely placed deeper than 40 cm in sprinkler irrigation or 60 cm in drip irrigation, because wetting fronts are often too weak to be detected at such depths.



The FullStop Wetting Front Detector (far left).

The funnel part is buried in the soil with the tube protruding above the soil surface (near left).

Flood irrigation raises two problems. Firstly, flood irrigators need to apply a large amount of water at one time, so fairly deep placement is necessary. Secondly, when the soil is flooded, the structure of the soil plays a greater role in the infiltration speed and pattern compared to sprinkler and drip systems, which generally apply water at rates below the saturated hydraulic conductivity of the soil.

Flood irrigation requires a WFD that has a greater sensitivity to capture weaker wetting fronts deeper in the soil and can be installed in such as way that it will not be activated by water moving through cracks or preferential pathways.

The LongStop WFD fulfills these requirements. It was evaluated in a flood irrigated cotton crop on a grey cracking clay soil, an experiment funded by the National Program for Sustainable Irrigation.

Whereas the FullStop will detect wetting fronts when the soil wets up to around 3 kPa suction, the LongStop WFD detects much weaker fronts (the soil only has to wet up to 10 kPa suction). The researchers placed FullStop WFDs at 30 and 50 cm depth below furrow level in the centre of the cotton beds. LongStop WFDs were placed to measure fronts passing 50 cm and 100 cm.

After the first season, all 16 FullStop WFDs recorded the passing wetting fronts in the clay soils, responding at 30 and 50 cm depths. In the second season, they were placed at 70 cm depth and they all responded there too. FullStop WFDs also indicate how long the soil remains waterlogged after irrigation, because the indicator float cannot be returned to the reset position until the soil has removed the water from the detector by capillarity. The FullStop WFD has sold over 10,000 units.

While the LongStop WFDs didn't perform adequately in the first season, they are performing much better in the second season, after the soil has been through a few wetting and drying cycles. The LongStop WFD will, however, spend a year or two in the laboratory being refined.

For more information on wetting front detectors, please see the website www.fullstop.com.au

For more technical information:

Stirzaker, R.J. 2003. When to turn the water off: scheduling microirrigation with a wetting front detector. Irrig. Sci. 22: 177-185.

Stirzaker, R.J. and Hutchinson, P.A. 2005. Irrigation controlled by a Wetting Front Detector: field evaluation under sprinkler irrigation. Aust. J. of Soil Research 43: 935-943.

Hutchinson, P.A. and Bond, W.J. 2001. Routine measurement of the soil water potential gradient near saturation using a pair of tube tensiometers. Aust. J. Soil Research 39: 1147-1156.

This Fact Sheet is available from the NPSI Website at: www.npsi.gov.au

The National Program for Sustainable Irrigation focuses research on the development and adoption of sustainable irrigation practices in Australian agriculture. NPSI has 14 funding partners: Land & Water Australia (managing partner); Sunwater, Queensland; Horticulture Australia Limited; Goulburn-Murray Water, Victoria; Cotton Research and Development Corporation; Harvey Water, Western Australia; Lower Murray Water Authority, Victoria; Wimmera Mallee Water, Victoria; Ord Irrigation Cooperative, Western Australia; Australian Government Department of Agriculture, Fisheries and Forestry; Department of Natural Resources, Mines and Water, Queensland; Department of Primary Industries and Resources, South Australia; Department of Environment Water and Catchment, Western Australia; and Department of Agriculture and Food, Western Australia.

ISBN: 1921253622
Product Code: PF071311

Disclaimer