# New drainage meter for Burdekin Initiative

By Philip Charlesworth, CRC Sugar and CSIRO

Burdekin sugarcane farms will be among the first in Australia to have new technology installed for monitoring deep drainage.

The equipment will be an integral part of the Burdekin Initiative research program (see footnote on page 12 for organisations involved in the Initiative).

The major objective of the Burdekin Initiative is to address questions raised regarding the longer term sustainability of water management practices in the Burdekin delta and their interaction with the underlying aquifers.

The new tool for determining deep drainage in soils is currently being prototyped by Paul Hutchinson of CSIRO Land and Water in NSW.

Its development will continue with installation at five sites in the Burdekin delta. Data from the instruments will be used to assess the contribution to

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drainage of different soil types and irrigation practices.

A common definition for deep drainage is any water moving beneath the crop root zone. Drainage is the hardest water output from the cropping system to measure as it occurs at some depth beneath the surface and any disturbance of the soil has potential to affect the reading. Drainage measurements in the past have been subject to large errors and only sophisticated research equipment can monitor what is happening. With increasing environmental pressures on irrigation managers accurate

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FIGURE 1: Diagram of the drainage meter

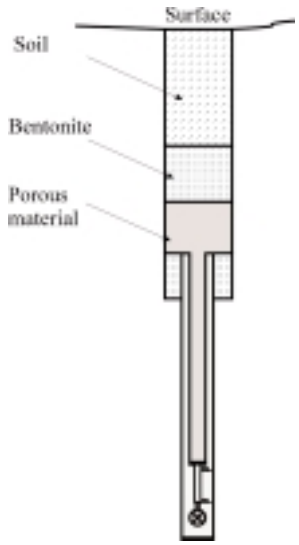
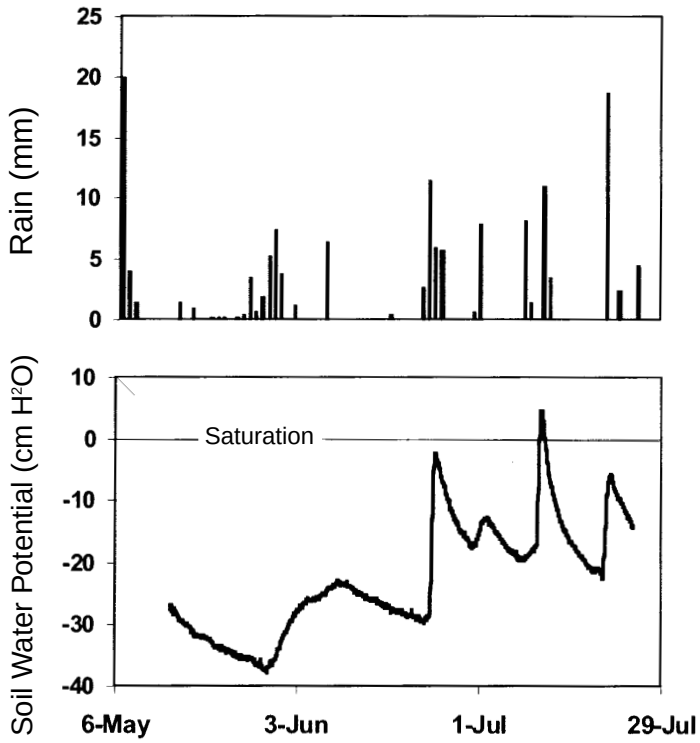


FIGURE 2: Rainfall effects on water status at one metre beneath a wheat crop

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measurement of all inputs and outputs, and particularly drainage, from the system is paramount.

## DUAL FUNCTION METER

The prototype, known as the drainage meter, can be likened to test wells which are sunk to monitor watertable heights in irrigation areas. In addition to measuring the rate of drainage, salt movement and nutrient leaching can both be monitored because the device allows for the collection and analysis of a water sample from beneath the rootzone.

The rate at which water moves through soil is related to the soil wetness. The meter captures this relationship by functioning as two instruments in one.

First, it acts as a tensiometer to measure soil moisture. The meter comprises a 1.5 metre tube which is filled with a porous material (Figure 1). The tube has a top open to the soil and a cavity at the bottom. Moisture from the surrounding soil flows through the porous material into the cavity.

If the cavity completely fills with water then a watertable forms within the porous material. The height of this watertable is directly related to how wet or dry the soil is surrounding the top of the tube.

The second function of the meter is to measure the drainage rate at the measured soil moisture level. If the cavity is kept empty by frequently removing any water that has collected in it, then the amount of water collected is related to the drainage.

Tubes are installed into 50 mm diameter vertical holes drilled to a depth of 1.5 metres below the rootzone. In the case of sugarcane, where roots are generally in the top 1.5 metres, this means the hole would be drilled to a depth of three metres.

The tube is dropped into the hole then backfilled with bentonite clay, which prevents water from entering the hole from the surface and affecting measurements.

## FIRST RESULTS

To date the tensiometer function of the drainage meter has been tested. Data have shown the drainage meter can measure soil moisture as accurately as expensive mercury tensiometers.

And the drainage meter doesn't have the the disadvantages of commonly-used, water-filled tensiometers. No regular maintenance schedule is required and the instrument is buried beneath the plough layer keeping it well protected from tillage damage.

Some of the first results from the drainage meter are presented in Figure 2. The response of the soil moisture level to a series of rain events as measured by the drainage meter at a depth of one metre is shown. Clearly, the meter is detecting successive wetting fronts within a short time of the rain falling. The profile is close to saturation after June 28 representing the period the profile is draining at the greatest rate.

Installing a drainage meter in a Burdekin canefield

With the first drainage meters to be installed in October, Burdekin canefields will provide a testing ground for the next phase of development — the ability of the meter to measure how conductive the soil is to water. Following this, water sampling from the meter will be automated to allow regular analysis of solutes and nutrients.

After the meter passes its initial field testing, work will commence on modifying the system to make it as user-friendly as possible with the ultimate aim of introducing it as another tool farmers can use to help optimise their operations, and especially their irrigation scheduling.

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