

## Soil Moisture Monitoring

Water is the most essential input for plant growth. It is needed in much greater quantities than any other input. While other inputs are retained by the plant, water is primarily on a one-way and continuous flow from the soil through the plant roots to the leaf surface to be transpired to cool the leaf.

Water is the single most important factor influencing yield and quality of any crop — dry matter, grains, seeds, grapes or fruit. Limit the supply of water to the crop and it will:

- Decrease the rate of evapotranspiration and photosynthesis;
- Decrease the rate of leaf growth; and
- Decrease grain or seed growth.

In the extreme limiting water supply to crops is plant death.

Rainfall is the most variable aspect of weather, thus getting sufficient moisture from rainfall alone for plant growth can be a major risk for growers. Irrigation is necessary to ensure crops always have sufficient soil moisture to optimise production. Not only is irrigation essential, so is the proper management of the irrigation. Rarely during any growing season on any soil type will irrigation not benefit crop production.

### The Irrigation Season

In eastern New Zealand, irrigation can begin in August and not stop until May, i.e. a season of 7–8 months. Irrigators must be prepared to start early, finish late and in some seasons not stop in between. Irrigation is a 7-day a week task that simply cannot be missed if production is to be optimised.

### How Much Irrigation

This will depend on soil type, daily crop water use and the prevailing weather. These three factors are inextricably connected to ensure water is supplied to the crop before it becomes so dry the plants cannot grow at optimum rates. There are two extremes in soil types and local environment:

1. Shallow stony soils (less than 300mm top soil) that will have only 20–25mm of readily available moisture in this soil depth — very little! Often regions with these soils are also prone to Northwesterly winds. These winds can have dramatic effects and increase the amount of water transpired by the crops two to three-fold.
2. Deeper soils and those with higher clay content have the most available soil moisture. They require the least amount of irrigation.

### The Effect of Getting Behind

Irrigating farmers are most likely to get behind when irrigation is too late starting and/or during a westerly weather cycle. Starting too late can result in “never catching up” until there is a significant rain. During windy westerly conditions water use by crops can be as high as 7–8mm, much greater than the ability of the irrigation system to keep up. Once soil moisture drops below the critical deficit (the soil moisture content when plants struggle for water) plant growth is affected. Production will decrease by 0.2–0.3% per potential mm transpired (the mm/day used before reaching the critical deficit) below critical

deficit. For example, pasture production could fall from 70–80kg/ha/day dry matter to 50–55kg/ha/day dry matter in 7-10 days if irrigation is too late or unable to be applied.

## Measuring Soil Moisture

HydroServices measures soil moisture in the soil to accurately determine irrigation requirements. Soil moisture is measured with a neutron probe and dielectric sensors. These direct measurements remove any assumptions and doubts associated with evapotranspiration models.

To measure with a neutron probe, aluminium access tubes are set into the soil at key locations. Soil moisture is measured on a regular (usually weekly) basis at several depths. The readings from the tubes are averaged to provide an accurate assessment of the soil moisture content in the field or crop. This allows an irrigation management programme to be developed in consultation with the grower.

Dielectric soil moisture sensors are installed at 2-3 depths in a soil profile to provide continuous telemetered soil moisture measurements. The sensors are field calibrated to provide precise measurement. The soil moisture record is accessed on the HydroServices website with a username and password.

## How the measurements are used

For each field or crop monitored by neutron probe, the amount of moisture in the critical root zone layer of the soil and subsoil layers is plotted in an irrigation management report. This report is provided for the grower, is;

- in the form of an easy-to-read graph and is updated weekly or whenever measurements are made, or
- emailed to the grower the during the day measurements are made.

Each crop monitored continuously, the data is audits and irrigation management advice provided on-line 2–3 times a week.

Irrigation management aims to keep the moisture between the full and stress points so that there is sufficient moisture for optimum growth. If the moisture falls below the stress point, yield will be decreased and quantity diminished. If irrigation raises soil moisture above the full point, the excess drains through the soil, wasting water and leaching valuable nutrients.