



Hunter Starting Smarter Irrigation Project

A knowledge inventory for Monitoring Soil Moisture

Do you know how much water is available in your soil at the start of the irrigation season?

The purpose of irrigation is to ensure plants have the right amount of water available for optimum growth. This is the essence of irrigation management. Research shows that commencing irrigation too late impacts upon the potential dry matter production of many dairy irrigators and, therefore, farm profit. A vital piece of information for deciding when you should start irrigating is the amount of water stored in your soil.

If there is not enough water in the soil, the pasture or crop will not develop as it should and you may be setting yourself up for long-term soil moisture deficits throughout the irrigation season. Conversely, over irrigating can lead to waterlogging of soils and wastes expensive water and power inputs.

There are two simple ways to determine soil water status:

- Soil moisture monitoring using a probe
- Water balance using weather data

What do I need to check?

To ensure you can adequately monitor your soil moisture and plan your irrigation scheduling accordingly in the coming season, check that you have the following in place:

- ✓ Are you monitoring your soil moisture?
- ✓ Do you know your soil RAW (Readily Available Water) for the pastures or crops you intend to grow? – this is fundamental information required for soil moisture monitoring.
- ✓ How many methods of monitoring do you use? – ideally more than one should be used.
- ✓ Do you know the capacity and how much water your irrigation system is applying? – To apply the amount of water your soil moisture monitoring indicates is needed, you need to know how to set your irrigation system to reliably deliver this amount.
- ✓ Do you know how evenly or uniformly your system is applying water? – If your irrigation system is irrigating unevenly, over-watering and under-watering is likely across the paddock resulting in poor plant development and therefore lost production.

USEFUL GLOSSARY

BOM- Australian Bureau of Meteorology

ET- *Evapotranspiration* provides a relatively objective and reliable estimate of the water requirements of actively growing plants in a farm situation. Evapotranspiration depends on a number of factors including sunlight, wind, **temperature and humidity**.

ET_o – *Reference Evapotranspiration* specifically refers to the rate of evapotranspiration from a very actively growing, well-watered grass stand which is 120mm in height. In terms of its water use, this standard reference pasture stand provides a workable representation of good productive pastures across a well irrigated farm.

ET_c – *Crop Evapotranspiration* which is obtained by multiplying ET_o by K_c (refer below).

EM38 – A geographical survey that provides a rapid measure of soil electrical conductivity. Soil tests are used to calibrate survey information so that estimates of at-depth soil water potential can be determined.

IrriSat – a crop water use tool using satellite and local weather data available by clicking [Here](#) .

K_c – *Crop Coefficient*. This modifies the plant water use if the crop is not pasture. A conversion factor of 1.0 is applied with ET_o for healthy productive pasture. However, in many circumstances, other crops will have different water requirements than healthy productive pasture. Eg. lucerne at early flowering stage or a tall actively growing crop of maize or sorghum is likely to use more water and the appropriate crop coefficient will approximate 1.2. This means that these crops require 120% more water than good pasture under the same conditions to achieve top growth rates and yields.

RAW- *Readily Available Water* to plants will vary depending on the soil and plant characteristics. Eg. for an established ryegrass pasture an assumed 40mm of RAW is used. This figure may vary somewhat for different paddocks or farms. It will be lower for newly established plants with a shallower root system and is likely to be higher for crops like lucerne or maize with a deeper root system .

Scheduling Irrigation Diary (SID) – a weather based scheduling and recording tool which has been recently updated and trialled for dairy (not yet widely released). You can use this tool on your PC or as an App. Access SID [Here](#).



Soil-based monitoring

Soil moisture monitoring probes use a number of indirect methods that measure the properties of the soil which vary with water content. It is therefore important that equipment decisions and paddock location are determined by commonalities/ differences in soil characteristics and pasture/ crop varieties being irrigated.

Pre-installation checks

- ✓ Are you working with a trusted irrigation agronomist who can assist with interpretation of SMM data, pasture/crop water demands, system capacity and irrigation scheduling decisions?
- ✓ Do you know the soil types and characteristics of the soils under your irrigation system?- Consider having an EM38 Survey undertaken.
- ✓ Have you considered the variation in rooting depth and water requirements of the pastures/ crops under your irrigation system
- ✓ Have you made an informed decision about the type of probe, depth of sensors and data-logger which is best for your situation? - Check the [Irrigation New Zealand Soil Moisture Monitoring Guide](#) to build your knowledge.
- ✓ Are your probes located in a location which represents the majority soil type/ characteristics of your irrigated area?
- ✓ Do you have good enough knowledge of the variation in other soil types/ characteristics in the paddock so you can calibrate SMM data accordingly and adjust your irrigation?- you may have an option to segment your water application.

Pre-season checks

- ✓ Does the location of your probe/s and depth of sensors still make sense when considering changes to your pasture/ crop varieties this season?
- ✓ Did the previous season's readings make sense? – anomalies might indicate a problem.
- ✓ Are the probes soundly installed in the soil, with no disturbance or vertical soil cracks? – inadequate installation will give false readings.
- ✓ Are the cables and conduit intact, protected, and adequately sealed? – problems here will give false or null readings.
- ✓ Is the logger undamaged, clean, securely mounted and protected with sound fencing so the cows cannot access?
- ✓ Is the inside of the logger clean, dry, and insect/ rodent free?

- ✓ Are the batteries charged and performing properly? Do they need to be replaced?
- ✓ Is the telemetry functioning properly? – if not, there may be problems with the equipment, the software, or the line of communication (eg. trees may have grown up into the line of sight).
- ✓ Are the readings downloading properly to your computer or device? Are there any unexplained data gaps? Are the readings and traces displaying properly? – if not, there may be a software or equipment problem that should be fixed before the season starts.

Weather-based monitoring

Pre-season checks

- ✓ Are you set-up and accessing reliable ETo readings from your nearest BOM site or a freely available water balance tool such as IrriSat or Scheduling Irrigation Diary (SID)?
- ✓ Are you accurately measuring rainfall on the farm?
- ✓ Do previous season and cooler month figures from these sources make sense? – any anomalies might indicate a problem with the source data or calculations.
- ✓ Have you determined the range of Kc values for the pasture or crop you are growing this season? If you are using a water balance tool, these are most likely predetermined by back-end calculations. Contact the developer if you need a specific crop/ pasture Kc added to the tool as this is usually simple to do.
- ✓ To independently source Kc values consult with your trusted irrigation agronomist or refer to Chapter 6 of this resource: Click [Here](#).
- ✓ Are water balance reports/ graphs downloading properly to your computer or device? Are there any unexplained data gaps? – check if the problem is at the source end or with your device prior to the start of the season.
- ✓ Do you have the right knowledge to confidently interpret the irrigation scheduling advice provided by the water balance tool and make site based judgments during the upcoming season?

Season checks

- ✓ Are you entering all your irrigation applications into the water balance tool of choice?
- ✓ Are the rainfall and ET values used by the tool correct for your property- you can override these values if you have site based information.
- ✓ Are you regularly consulting the tool and your soil moisture monitoring information to re-adjust your irrigation scheduling to optimise water, power and labour use?