Planning for Variable Rate Irrigation

EM38 soil mapping for irrigation planning

This fact sheet is part of the Profitable Dairying series - *Good business management reduces greenhouse gas emissions.*

Good irrigation planning and management with variable rate irrigation can help grow high quality feed, which reduces methane emissions from cows.

Good irrigation allows for best utilisation of applied N and minimises leaching and nitrous oxide greenhouse gas emissions, especially in poorly drained parts of the paddock.

Variable rate irrigation can reduce pumping costs – water is only applied where needed – and can reduce carbon dioxide emissions from electricity generation.

Why and what is variable rate?

Often irrigators are moving over variable soil types and topography. Some soils drain quickly and get too dry for optimal pasture growth. Some soils are poorly drained. Soil pugging, compaction and poor pasture growth can result in these areas. Variable Rate Irrigation (VRI) allows farmers to target the right rate and right place for optimal irrigation performance.

Increasingly farmers are looking at fitting VRI technology onto pivot irrigators. This technology involves controlling solenoids, which turn on and off according to maps of the pivot circle, adjusting the amount of water applied as the pivot moves through its arc.

Planning is critical

VRI packages fitted on pivots typically cost around $50,000, although prices vary with pivot size and between manufacturers and dealers. Mapping the pivot circle to pick up soil type and topography variations is critical. The VRI controller on the pivot will operate according to software inputs.

Often contours and drainage are a bigger influence than soil type on VRI configuration. It pays to speak with a good irrigation designer prior to EM38 surveying.

Basic mapping can be walking the paddock with a handheld GPS to mark out wet and dry areas. Real Time Kinematic (RTK) GPS mapping is required for accurate contour mapping to give more accuracy around drainage and runoff.

EM38 mapping is a precision agriculture technology used for zoning soil types. EM38 measures the apparent electrical conductivity of soil through the use of electromagnetic sensors. The sensors are applied across the soil surface by towing the EM38 unit in a grid pattern across the study area, and data collected is geo located by RTK GPS.

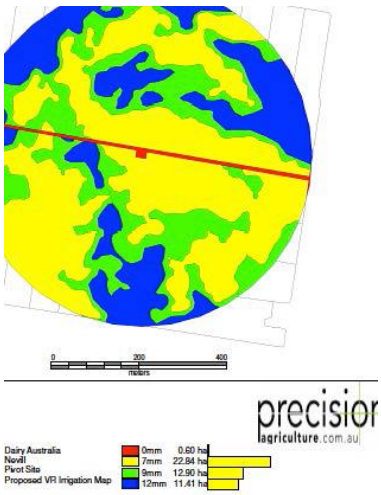
Once soil type zones are identified, soil cores can be extracted to determine soil moisture holding capacity, and from there, applicable irrigation rates can be prescribed.

How does EM38 work?

Technical detail on how EM38 mapping can be found here. Basically, the strength of the magnetic field between transmitting and receiving coils is dependent on the volume and type of water, salts, clay and rock within the soil. It is important to note that EM responds in variable levels to these soil characteristics and correlation with one of these characteristics can be weak, therefore simple interpretation is not always available. EM38 mapping should always incorporate ground truthing, with soil sampling done at the same time as the EM38 survey.

Photos (L to R): EM38 sensors being towed across paddock in a grid pattern to detect soil type differences. Once different soil types are identified, deep soil cores are taken with auger; soil cores are analysed to determine soil moisture holding capacity, irrigation rates can be generated to reflect variation across paddock.

Figure 1: Variable rate irrigation map generated from EM38 mapping



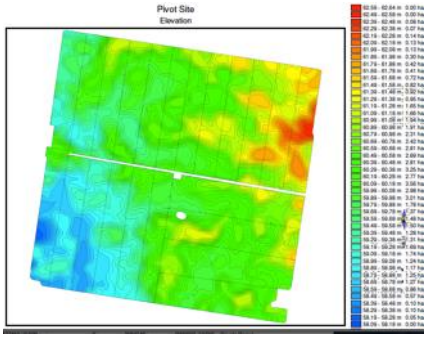
Configuring Variable Rate Irrigation

A VRI map can be generated from EM38 mapping (*Fig.1*) and incorporating the data from the contour mapping (*Fig. 2*). This prescription irrigation map will be loaded into the VRI controller on the pivot. The VRI controller technology will then control opening and closing of solenoids along the length of the machine, adjusting the amount of water applied to differently mapped areas.

For example, areas mapped in blue will receive 12 mm irrigation in a single pass (*Fig.1*). Areas mapped in yellow will receive 7 mm irrigation in a single pass.

The yellow areas have a higher clay content compared to the blue and green areas. The blue areas have the lowest clay content and will require a larger amount of water to be applied.

Figure 2: Contour map for paddock generated from RTK GPS mapping



Further reading:

www.precisionagriculture.com.au
www.irrigation.org.au

All of the commercial irrigation manufacturers now offer VRI options. See their websites for more details. Thanks to Precision Agriculture for some of the content provided in this document.

Published by Dairy Australia Limited with support from the Australian Government.

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