PROJECT: VARIABLE RATE IRRIGATION

CLOVELLY DAIRY

PROJECT DETAILS

Producer: Clovelly Dairy

Location: Bridport, TAS

Soil Type: Sandy

Enterprise: Dairy

Why did Clovelly Dairy want to implement VRI Technology?

Clovelly Dairy has a total of 1,133 hectares of pasture that is irrigated by 14 central pivots. Four of these pivots were installed with VRI software. However, because of uncertainty around how it could be effectively applied, only the basic technology (exclusion zones) was originally in use. Clovelly wanted to explore the full potential of this technology and demonstrate how this could be done elsewhere.

Although they knew that they had low water holding capacity due to a sandy soil type, the varying topography meant that there was still great potential to improve returns by being more precise with irrigation quantity, timing, and placement. Clovelly saw an opportunity to better utilise VRI to both increase pasture production, and reduce costs. The ability to turn off the water when the pivot was travelling over the laneways and drains could result in less laneway maintenance (saving money and time), improved animal health and less wasted water.

How does VRI work?

Variable-Rate Irrigation (VRI) technology applies different rates of irrigation water to management zones via a centre pivot irrigator equipped with a VRI control system. There are two types of VRI controllers:

1. A sector system which varies the speed of the pivot as it moves, with faster speeds reducing water depth applied in a sector and slower speeds increasing water depth applied in a sector.

2. A zone control system that can vary the rate of water applied in the direction of travel and along the length of the centre pivot through solenoid valves fitted to each nozzle. The valves are pulsed at different rates to adjust the desired application depth within each management zone.

Clovelly Dairy uses a zone control system (2) that allows the adjustment of water application to different zones within the centre pivot as well as excluding laneways and drains from the irrigation system.

Producing a VRI map

Irrigation requirements within a field are influenced by soil type, topography, crop type and growth stage, soil moisture status, and field layout. A VRI map is used to capture this in-field variability and turn it into a more precise irrigation strategy.

Clovelly Dairy had produced an initial VRI map for the pivot by using a handheld GPS and tracking around known wet areas (Figure 1a). This was a time-consuming process that relied on farm knowledge with a degree of guess work to generate the boundaries. While a good starting point for the original exclusion zones, Clovelly Dairy sought a more accurate and easier process to develop new maps that could maximise the benefits of VRI. The process for creating these improved maps is described below.

Firstly, base maps of soil type and elevation were created using an EM38-MK2 sensor. This sensor is dragged across a paddock and simultaneously measures the electrical conductivity and elevation:

- The apparent electrical conductivity (ECa) of soils is a measure of the volume and type of water, salts, clay and rock within the soil. This measurement indicates changes in soil type and consequently water holding capacity and infiltration rates.

- A precise elevation map was created using a highly-accurate GPS system. While elevation data can be collected from a tractors RTK GPS systems, this is not accurate enough to predict water movement across the area.

The results of the EM38 and elevation survey are shown in Figure 1b*, 1c*. Once the initial survey was complete the elevation data was used to predict where water would flow and accumulate (Figure 1d*).

Each paddock is unique in what factors are the main influences on the best base map for VRI zones. In this case, the EM, elevation and water flow model were used as the basis for developing the 5 VRI management zones, with farm tracks and drainage lines excluded to produce the final VRI map (Figure 1e*).

* See images over page

Implementation of the VRI map?

Once a VRI map has been created it is converted into a complete prescription map in a file format that feeds into the pivot to control the irrigation rate. The file is uploaded via a range of pathways depending on the system: some utilise software loaded onto the grower's computer and manually load the file onto the pivot, while others use a website to load in the map and send the control file remotely to the pivot.

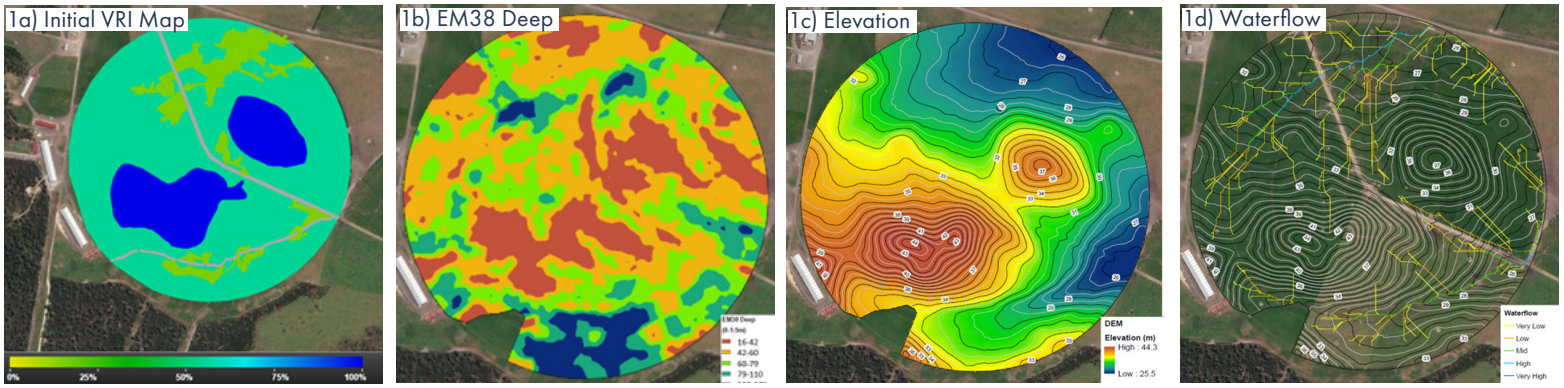


Figure 1. The development of the final prescription map for VRI control of a centre pivot. (1a) a manually generated VRI map created by Clovelly Dairy, followed by a more accurate and automated approach through the base survey (1b) EM38 and (1c) elevation data, along with (1d) water flow modelling.

At Clovelly Dairy, the map was uploaded through the Lindsay website (using FieldNET - http://app.myfieldnet.com). This wasn't a simple process and required some additional data manipulation. Having professional support to help facilitate this process was invaluable, especially during the initial setup of the pivot.

The different areas on the Clovelly Dairy pivot receive different proportions of irrigation water. The VRI rates on the pivot were set to 25% on the wet areas (zone 1), 50% in the 'normal' areas (zone 3) and 100% in the dry areas (zone 5). Therefore, if we set the rate to 20mm, the dry areas get 20mm and the wet areas are receiving 5mm.

Benefits of implementation of the VRI map?

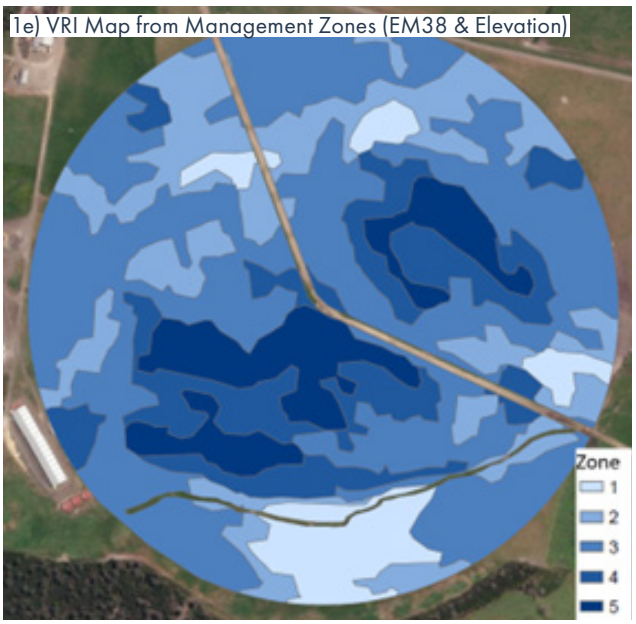
Improved water management and efficiency are the main benefits of implementing a VRI strategy. Water is saved by matching irrigation to land and soil characteristics and can also be adjusted for differing crops or growth stages. This can result in savings of 20 to 30% irrigation water volume on dairy and field crops, with direct cost savings on both water and reduced pumping (energy) costs.

In addition, the ability to exclude irrigation from drains, gateways, laneways, water troughs, streams and other infrastructure under your pivot, saves more water but also protects these assets and reduces maintenance costs. Reduced muddiness on laneways can also improve the movement of cattle around the farm and general trafficability.

An advantage of having a sound base survey of the pivot is the ability to install soil moisture sensors into different zones to monitor real-time soil moisture status. This information can then be used to optimise variable rate irrigation scheduling.

For Clovelly Dairy specifically, the main benefits of VRI were:

- the correct water application (the right amount, at the right time, in the right place),
- maximising input use efficiency (ensuring that fertiliser is not leaving the farm in run off, laneways are not getting bogged up due to being irrigated, pasture growth is not limited),
- reducing damage (reducing the risk of pugging, and preventing the soil drying out or becoming waterlogged),
- reducing costs (such as water usage, running costs of equipment, and less reliance on purchasing in supplements through greater pasture productivity).



These layers are used to generate (1e). The final 5 zone VRI map.

Potential Issues?

During the growing season there are often changes in the spatial distribution of growth in the crop or pasture. This may require the adjustment of the VRI zone maps as the growing season progresses.

On-going monitoring of the VRI system is essential to ensure the zone maps continue to reflect crop water requirements across the pivot, and that the control system and sprinklers are performing as expected. established and monitored in terms of potential impact on production?

ACKNOWLEDGEMENTS

This project was funded by DairyTas.

To start your VRI journey, contact Precision Agriculture today.

1800 773 247
sales@precisionagriculture.com.au
precisionagriculture.com.au

SCAN ME

precision agriculture