Variable Rate Irrigation on variable soil types

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- Type of farm – irrigated cropping and livestock
- Area – 1800 ha total, 550 ha under cropping
- Crops – potatoes, poppies, carrot seed, cereals, clover and brassica pastures for grazing
- Livestock – sheep
- Soils – everything from sand to clay, various duplex soils and stoney red soil
- Irrigation – two VRI pivots (one Zimmatic, one Valley)

Background to variable rate irrigation (VRI)

- The Valley pivot spans 730 m and irrigates an area of 180 ha.
- Variable soil types under the pivot led to over- and under-watering when subject to uniform irrigation applications. This was particularly problematic for high input crops (e.g. potatoes) due to yield loss in waterlogged areas.
- The Valley VRI controller was purchased for the 2024 cropping season and retro-fitted to an existing Valley pivot. The Zimmatic pivot was installed much earlier, in 2008. It was fitted with a VRI controller at the time of installation.

Process

- The paddock in question had been mapped previously for drainage planning, so soil data from EM38 and accurate topographic data were already available.
- The existing EM38 and topographic data were used to develop a VRI map which allows the amount of water applied to be varied based on the capacity of the soil to infiltrate or store water.
- Costs for VRI maps vary on the area of the pivot - <15 ha = $800; 15-30 ha = $950; >30 ha = $1100 (ex GST). A seasonal update costs $450. Added to this is the base cost of $30/ha for EM38 and elevation mapping, which in this case had already been done as part of drainage planning.
- While the VRI map generated from EM38 and topographic data is a very good start, it needs to be ground-truthed against soil and slope characteristics and adjusted accordingly.
- VRI maps are also adjusted based on observations during the growing season to ensure the application regime matches the growth stage and water demands of the crop.
- Knowledge and skills were accessed through external consultants (Ag Logic) for in-paddock soil mapping and development of VRI maps.
- The VRI controller requires 4G to communicate and function and Ag Logic sends VRI maps and data direct to the VRI software.

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Outcomes

- Soils under the pivot range from free-draining, which can often be dry, to limited drainage resulting in waterlogging when the irrigation application was at a uniform rate across the whole pivot. VRI allows application rates to be varied depending on the soil type and the crop demand.
- VRI provides more effective application of irrigation water so it is going where it is needed and not on areas subject to waterlogging.
- The expectation is that this will lead to increased potato yields through fewer loses from waterlogging and associated disease.
- Weekly observations followed by adjustments to the VRI map take about 6-8 hours per week, which is a significant time investment but worth it for high input crops (e.g. potatoes), particularly to minimise the risk of overwatering.

Benefits

- The purchase of VRI was less about saving money on water or other aspects of irrigation and more about improving crop uniformity and yield through elimination/reduction of waterlogged areas and ensuring that drier areas of a paddock got sufficient water. Given the variability in soil types under the pivot, it is not possible to achieve effective irrigation without the use of a VRI controller.

Postitives

- Makes irrigation on variable soil types more effective and better for the crop

Negatives

- Considerable time and skill required to ground truth VRI maps. The maps developed by the modelling give a reasonable result most of the time, but for high value crops it is worth refining the application maps based on observation and knowledge.
- The VRI controller is not particularly user friendly, which is an issue when weekly updates and adjustments are required at what is always a busy time of the season. Of the two controllers on the farm, the older installation is easier to use and program.

Conclusions

- **The best returns for VRI are obtained on the most difficult paddocks – i.e. paddocks with significant soil type variation and including soils that are prone to waterlogging or have poor infiltration.**
- **Getting the most value from VRI requires constantly adjusting the application map in response to crop demand through the growing season, particularly for high input crops.**

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