Smarter Irrigation for Profit

Advanced data-driven irrigation

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Roadmap!

- Smarter irrigation project context
- The power of data to inform decisions
- Current practice and the cost of getting it wrong
- Variable rate irrigation
- VARIwise autonomous control platform
Project 2b – Smart Automated irrigation

• Increasing farm profit through efficient use of irrigation input to dairy pastures

– Five Farmer sites
  • 4 with human interface
  • 1 with Automation (VARIwise)

• Year 1 – collect data only
• Year 2 – provide information
• Year 3 – Interact with the farmers
The power of data (information)
Powerful Impact

• Measured results before and after pump and motor replaced
• 787 kWh/ML vs 266 kWh/ML
• Savings of $120/ML or more than $15,000 for the season
Cressy Pivot
Site variability maps
<table>
<thead>
<tr>
<th>Site</th>
<th>Total stored water to 1.0 m (mm)</th>
<th>Total stored water in 30 cm root zone (mm)</th>
<th>Readily available water in 30 cm root zone (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cressy A</td>
<td>476</td>
<td>35</td>
<td>19</td>
</tr>
</tbody>
</table>

**Roots**

- 40 cm: 25mm
- 30 cm: 19 mm
- 15 cm: 9.5 mm
Site summary

- Large highly variable site
- Issues with wet areas and bogging
- System capacity – 6.7mm/d
- RAW varies between 9 and 25 mm
- ETo – maximum 7mm in January

- Continuous irrigation required during mid summer and variable rate application could be beneficial
Irrigation scheduling and crop growth at Cressy from 2016 to 2018
Pasture growth rates 2016

Cressy 15/16

6.2 ML/Ha
Pasture growth rates 16/17

Cressy

4.1 ML/ha

Cutting silage  Grazing management
2016/17 Soil moisture

Under irrigating
The Green Drought

ETc 4.3mm  Rain and irrigation - 198mm required  191mm received
Pasture growth rates 17/18

Chart Title

4.6 ML/Ha
The opportunity cost in year 1

<table>
<thead>
<tr>
<th>Year Oct - Mar</th>
<th>Average growth rate kg/ha/d</th>
<th>Pasture growth t DM/ha</th>
<th>Irrigation ML/ha</th>
<th>Rain mm</th>
<th>GPWUI T DM/ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/16</td>
<td>34*</td>
<td>6.2</td>
<td>6.2</td>
<td>215</td>
<td>0.74</td>
</tr>
<tr>
<td>16/17</td>
<td>54</td>
<td>9.8</td>
<td>4.1</td>
<td>319</td>
<td>1.34</td>
</tr>
<tr>
<td>17/18</td>
<td>69</td>
<td>12.4</td>
<td>5.1</td>
<td>203</td>
<td>1.65</td>
</tr>
</tbody>
</table>

*Only measured from January 2016

- Opportunity loss of approximately 35kg DM/ha/d
- Opportunity loss of 420t pasture over 3 months for 117 ha pivot
- $200/t extra feed cost for purchased feed to fill the gap
- Over $80000 extra cost over 3 months
Summary

- The power of data – measure to manage
- Beware of the Green Drought
- Keeping the bucket topped up is key!!!
- Poor watering costs production and money
Variable rate irrigation

• Why variable rate irrigation?
• To manage variability due to
  – Management and infrastructure
    • laneways
    • Locking up paddocks for silage
    • Renovation of specific paddocks
    • Different crops under 1 pivot
  – Climate and temporal change
  – Soils and topography
34% reduction in irrigation
2ML/ha

Reuben Wells - AgLogic
Producing a base prescription map
Include Field Observations and Road

Final Map For VRI Control
Rob Bradley stated that “We’re putting the water where it needs to go, we’re using less power to do it, and we’re growing more grass”.
NCEA and Automation with VARIwise

Developing variable-rate irrigation prescription maps from:

(i) infield weather, soil, and pasture growth sensors
(ii) optimisation algorithms using calibrated crop production models in ‘VARIwise’ software
(iii) automated prescription map upload
Cameras on Pivots

- Pasture height used for irrigation
- Height is measured using quad bike sensor
- Smartphone-based cameras on pivot upload image and location

Location of 3 cameras on pivot:

Smartphone pasture sensor:

Height = 46mm
Height = 86mm
Automated irrigation for dairy pastures

- Image analysis extracts pasture features in camera image
- Compared with weekly quadbike height data
Automated prescription map comparisons

10-20% reduction in water use compared with flat rate applications
Acknowledgements

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