Application of Precision Agriculture to Sugar Cane

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Presentation Overview

- Introduction to Sugar Cane Agriculture
- Yield Mapping
- Directed Soil Sampling
- Variable Rate Application
- Economic Analysis
- Conclusions
Introduction to Sugar Cane Agriculture

- $2 billion Australian Industry
- Average yield of 80t/ha
- at $30/t equals $2400/ha
- high input crop
  - up to 800kg/ha of bulk fertiliser per annum
- High value/high input crop
  - might argue is a good candidate for PA
Development of a Yield Monitor

- No sugar cane yield monitor existed
- Working on the problem for 3 years
- Focusing on the mass flow measurement
- Examined 4 potential measurement techniques
- Patented yield mapping systems operating this season
Calibration Curves

\[ y = 0.1078x \]
\[ R^2 = 0.8395 \]

\[ y = 0.0484x \]
\[ R^2 = 0.8455 \]

Cumulative Sensor Reading \((x10^6)\)

Cane Cut \((t)\)
Sugar Cane Yield (t/ha)

- 10 - 20
- 20.1 - 40
- 40.1 - 60
- 60.1 - 80
- 80.1 - 100
- 100.1 - 120
- 120.1 - 140
- 140.1 - 160
- 160.1 - 180
- 180.1 - 200
- 200.1 - 220
- 220.1 - 240

Total Yield: 14287.6 t
Average Yield: 122.6 t/ha

Yield Map

Field 7a 1996
DAVCO FARMING
Burdekin

By Graeme Cox
16/10/1996
Directed Soil Sampling

- Soil sampling guided by the Yield Map
  - 12 sites
  - sampled at two depths (0-25cm, 25-50cm)
- INCITEC provided the soil analysis
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Histogram of Yield

Total Yield: 14287.6 t
Average Yield: 122.6 t/ha

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Yield Vs Magnesium + Sodium

Yield t/ha vs meq/100g

- ● Magnesium, Mg
- ▲ Sodium, Na
- ▲ 0.5Mg + Na
Soil Analysis Results

- Explain 64% of the yield variation with Sodium levels
- Explain 68% of the yield variation with Magnesium levels
- Explain 96% of the yield variation with Combination (0.5 Mg + Na)
Variable Rate Gypsum Application

![Graph showing the relationship between previous yield and gypsum application rate.]
Economic analysis

- Compared Blanket application Vs Variable rate application

- Most important factors
  - Cost of input
  - Value of Crop
  - Variability

- If all are high then pay back for PA is greatest
Cost/Benefit

- **PA optimum**
  - 20t/ha: $136000
  - 11.6t/ha: $234000

- **Blanket 20t/ha**: $5829

- **Blanket 11.6t/ha**: $71656

Cost: $50000 to $250000
Conclusion

– Successfully developed a yield mapping system for sugar cane.
– Directed Soil Sampling has shown a strong correlation between the yield maps and soil sodicity
– Variable rate gypsum application will be conducted
– Economic pay back is significant

Gratefully Acknowledge PIVOT for support, INCITEC for the soil analysis, DAVCO Farming for hardware (1996) and Red Hen Systems for hardware (1997).
Support from Pivot Ltd.

- Funding of field calibration trials of sensor
- Funding of necessary experimental equipment
- Funding of technical support for trials
- Organisation and support of complete system trials in 1998