



Sugar Research
Australia

Improving selection accuracy by accounting for site variability

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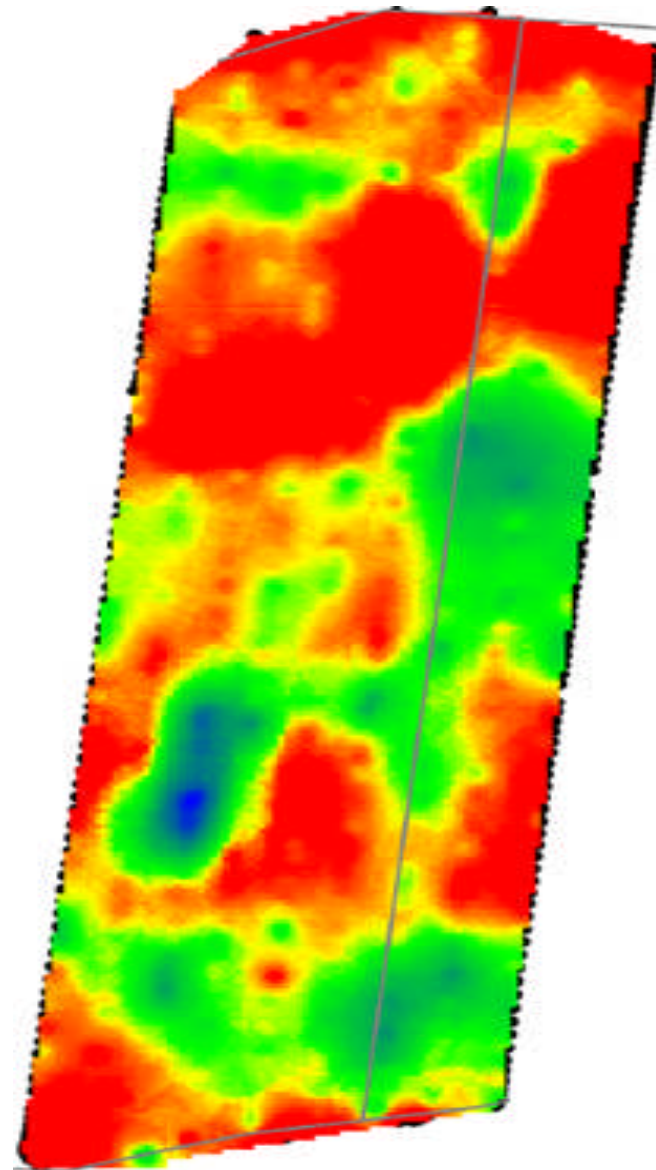
Essential Elements in Every Experimental Design

1. Randomisation
2. Replication
3. Reducing error

How to reduce the error when variation unknown

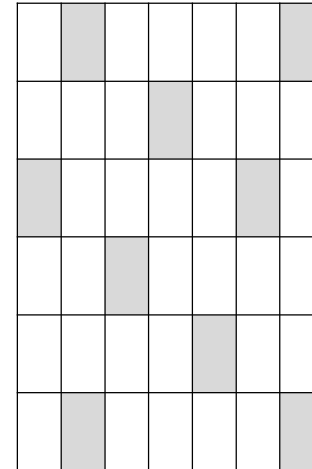
- ❖ Blocking
- ❖ But ...
- ❖ The larger area, the more problematic

ECa map of RAC12-28



Other techniques to reduce error

- ❖ Augmented design
 - Waste of resources
 - 20% plots for standards
 - Similar problems in blocking
- ❖ Reduce the size of blocks
 - Reduce the power of comparing clones between blocks
- ❖ Statistical
 - Spatial variation



EC/EM mapping technology

- ❖ “What is soil electrical conductivity?”

Soil is an electrical conductor. The soil EC is a measure of how easily an electric current flows through the soil. Soil EC responds to the amount of salt in the soil as well as indicates the soil’s composition – the amount of sand, clay, organic matter, and water content.”

H. J. Farahani, R. Khosla and G.W. Buchleiter, Colorado State Uni 2011

- ❖ Widely used in precision agriculture (PA)

Objectives of the study

- ❖ Whether ECa can tell us about site variability
- ❖ Whether the site variability identified by ECa is associated sugarcane growth
- ❖ Can ECa mapping be used to account for the soil variability in variety selection trials
 - In selection (this talk)

Burdekin trial

PNR13-28

P-design

56r x 30p

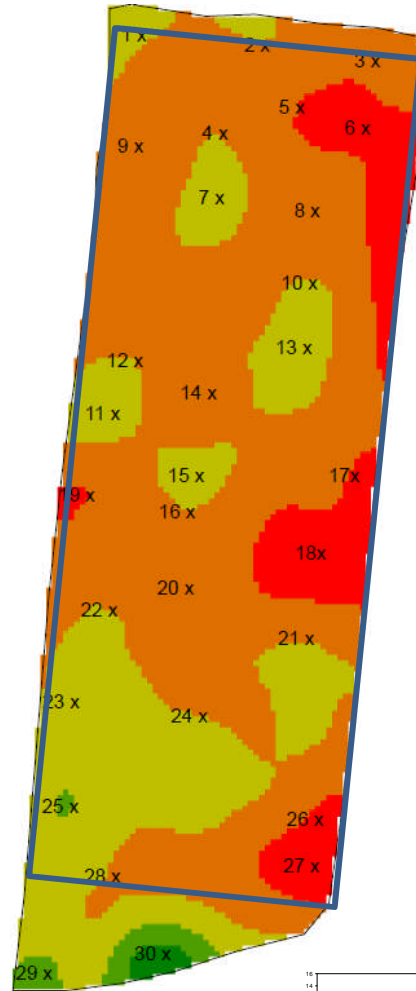
1398tc

1206 in 1R + 187
in 2R + 6 in 3R

2stds

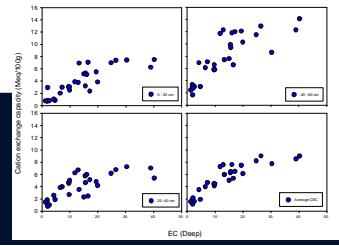
Q183^A in 35R+

KQ228^A 1 in 33R

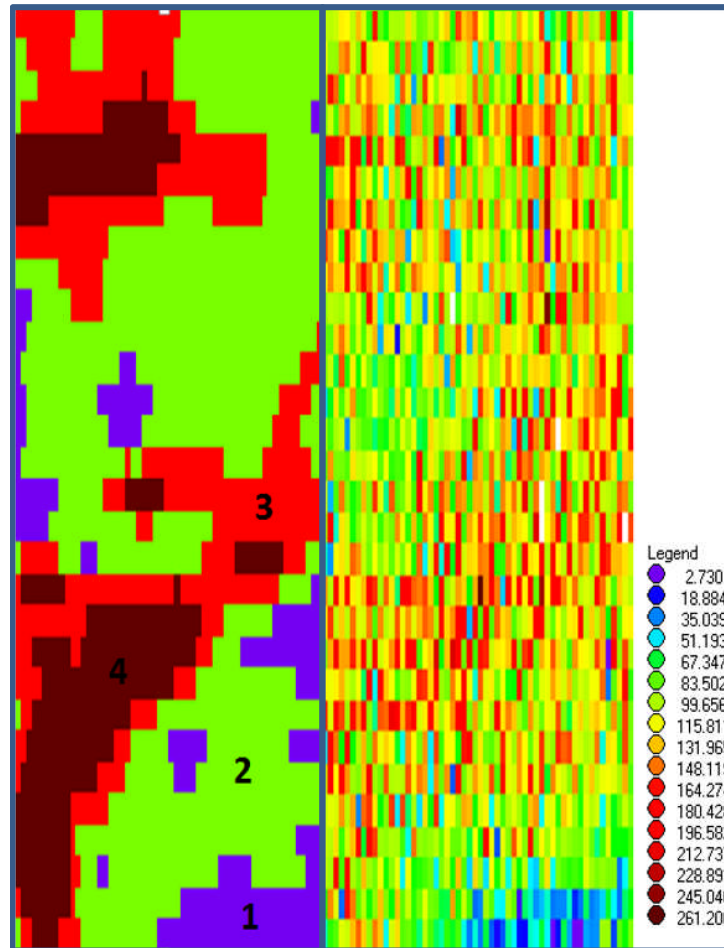


Cation exchange
capacity (CEC)
Meq/100g

Position	Burdekin lease farm Depth (cm)			Mean
	0-20	20-40	40-60	
1	14.0	16.3	16.1	15.5
2	13.6	16.2	23.6	17.8
3	9.0	8.5	10.4	9.3
4	15.7	17.7	19.1	17.5
5	11.6	10.7	10.7	11.0
6	12.0	14.9	12.4	13.1
7	21.9	21.3	25.4	22.9
8	14.7	15.8	18.4	16.3
9	15.8	17.9	21.5	18.4
10	13.7	14.3	14.9	14.3
11	16.2	16.3	12.2	14.9
12	16.6	16.7	13.6	15.6
13	11.6	12.8	13.2	12.5
14	13.4	12.6	11.7	12.6
15	17.0	22.9	32.0	24.0
16	17.2	16.0	15.7	16.3
17	12.7	12.5	14.3	13.2
18	12.8	10.9	10.5	11.4
19	13.5	12.8	16.9	14.4
20	18.5	16.9	20.0	18.5
21	11.4	11.3	10.4	11.0
22	17.3	17.9	23.1	19.4
23	20.3	19.5	23.9	21.2
24	15.4	16.2	12.0	14.5
25	23.0	30.4	36.2	29.9
26	12.8	8.4	6.2	9.1
27	8.3	8.2	6.7	7.8
28	17.0	17.0	16.4	16.8
29	21.6	24.7	34.7	27.0
30	17.7	19.2	16.3	17.7



Burdekin trial: PRN13-28



Burdekin trial: PRN13-28

Zone	Count of Clones	Mean of raw TCH	Ignoring ECa: Average clonal effects	Accounting for ECa	
				Average clonal effects	Zonal effects - TCH
1	124	75.3	0.0	0.0	0
2	613	106.8	7.0	0.3	17.5
3	294	118.2	8.9	0.0	25.0
4	175	122.2	10.9	-0.5	32.0

Burdekin trial: Impact on selection

Zone	No Clones under selection	Ignoring ECa		Accounting for ECa	
		Clones selected	Selection proportion	Clones selected	Selection proportion
1	124	9	7%	16	13%
2	613	68	11%	71	12%
3	294	48	16%	42	14%
4	175	25	14%	21	12%

Conclusion / Implementation

- ❖ Site variability was identified by EC, which was then associated with yield variation
- ❖ Site variability could affect selection if ignored
- ❖ Future work
 - Test selected clones in FATs to examine the realised gains
- ❖ Implementation
 - Conditions more favourable than PA
 - Plot weight available
 - Fine with unknowns

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