Cereal and legume crop responses to deep-placed K with and without P in North-Eastern Australian Vertosols

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Acknowledgements

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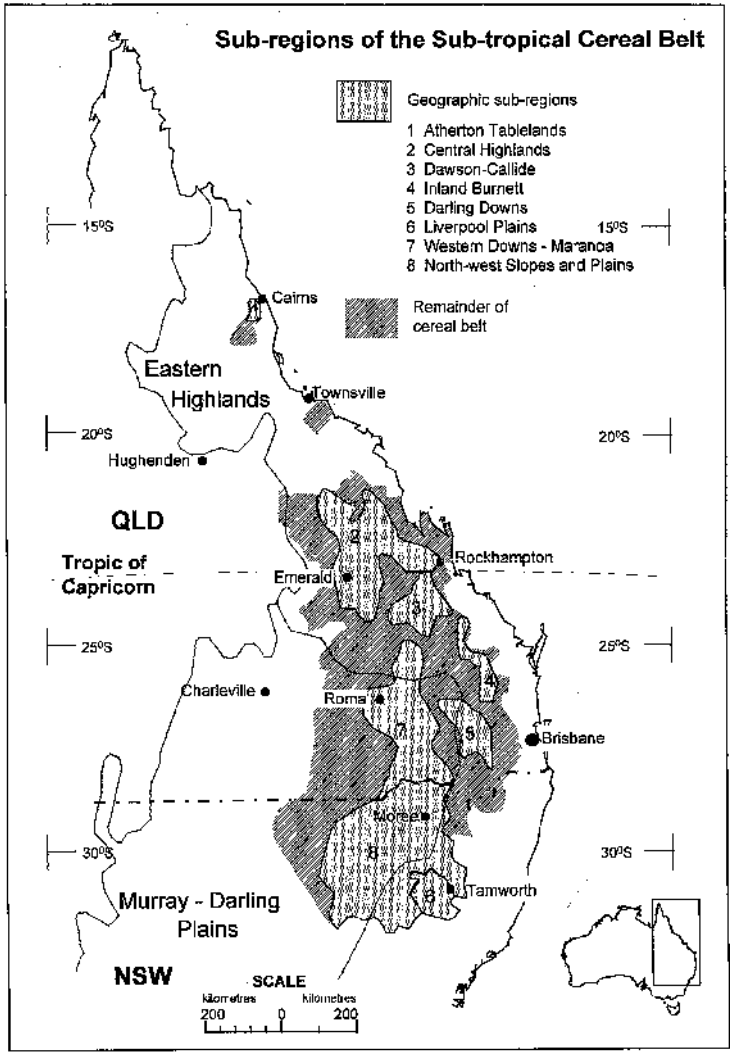
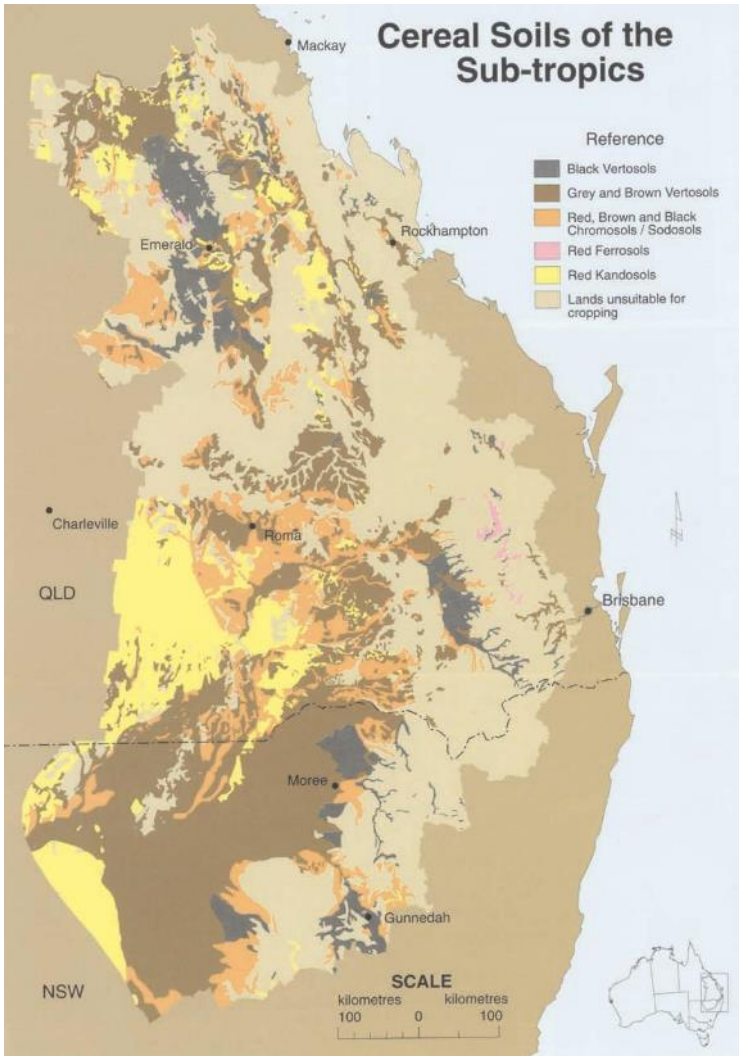
Structure

1. Context to the research
2. Hypothesis & Methodology
3. Results
4. Conclusions

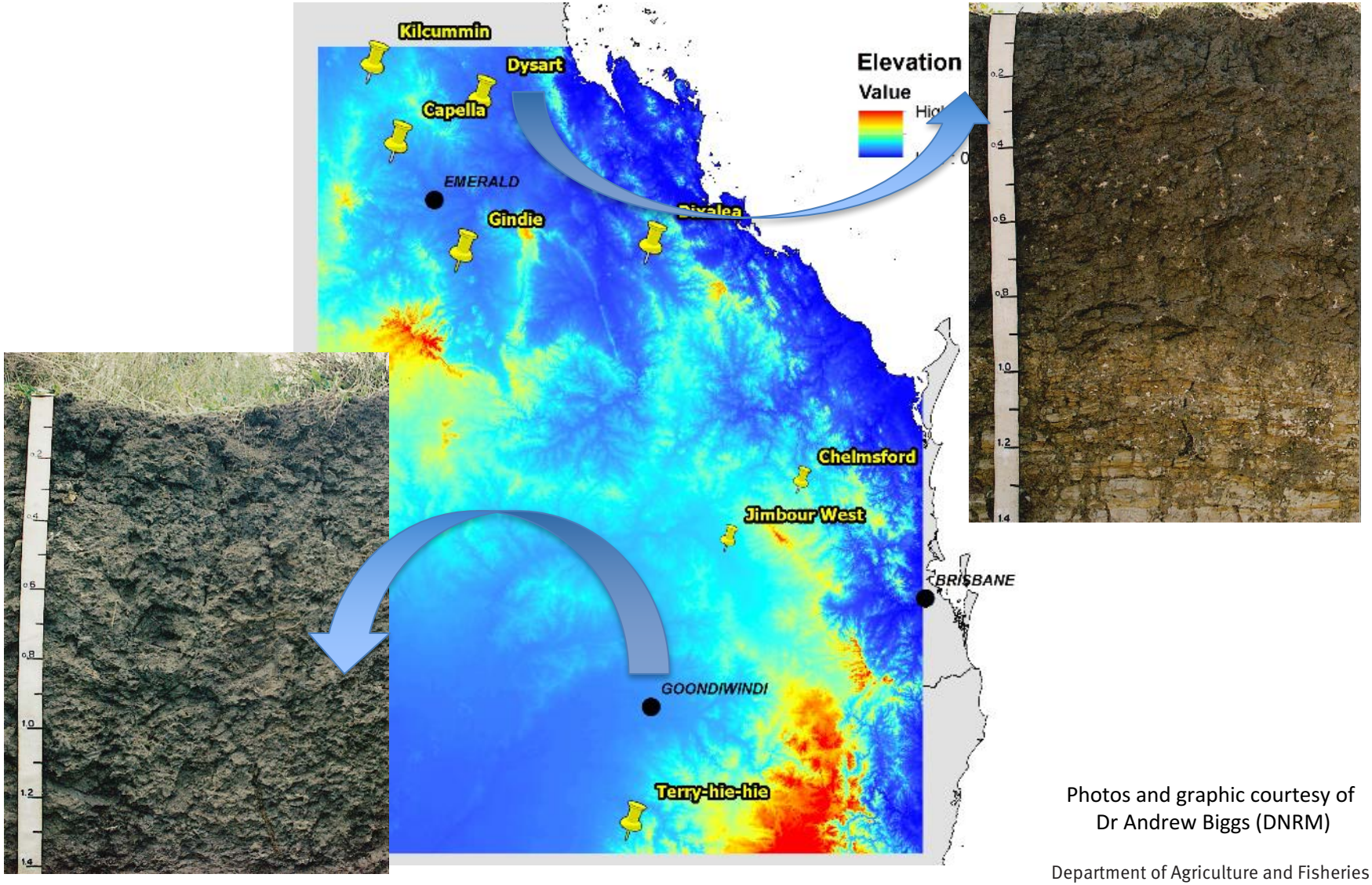
NE Australia: Geography and Soils





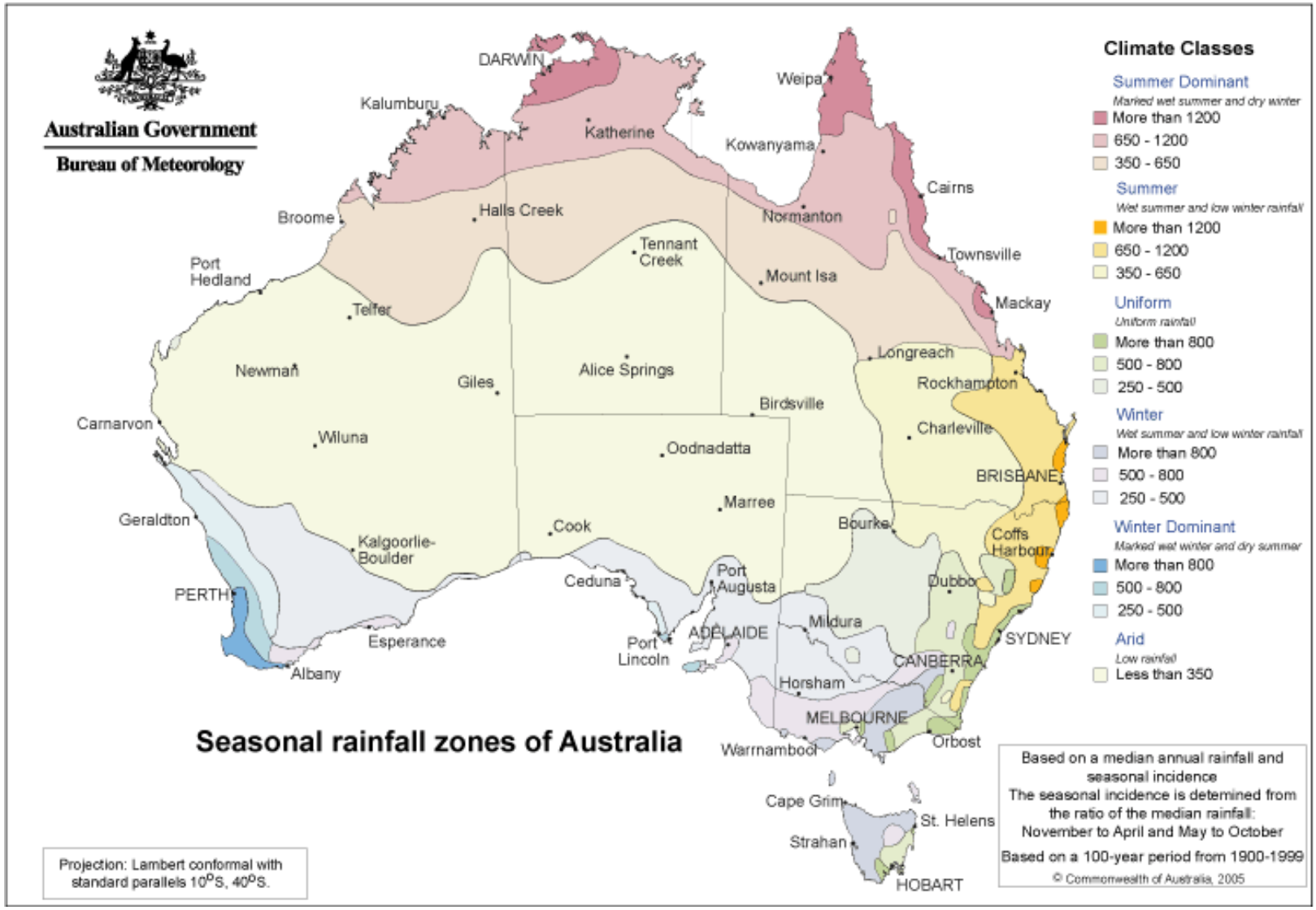
Webb et al. (1997) Used by permission.

Contrasting soil formation

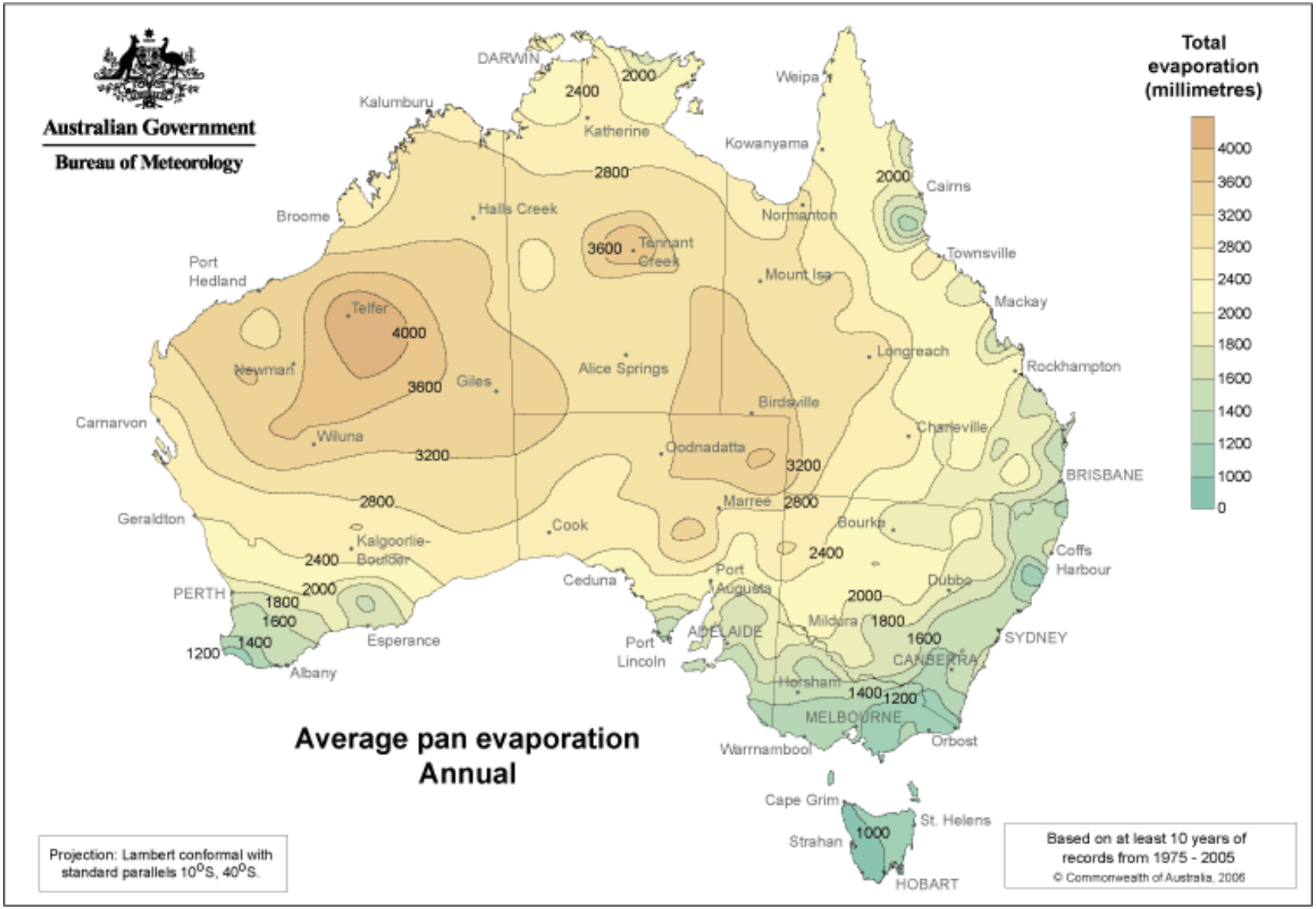


Photos and graphic courtesy of
Dr Andrew Biggs (DNRM)

Rainfall zones for Australia



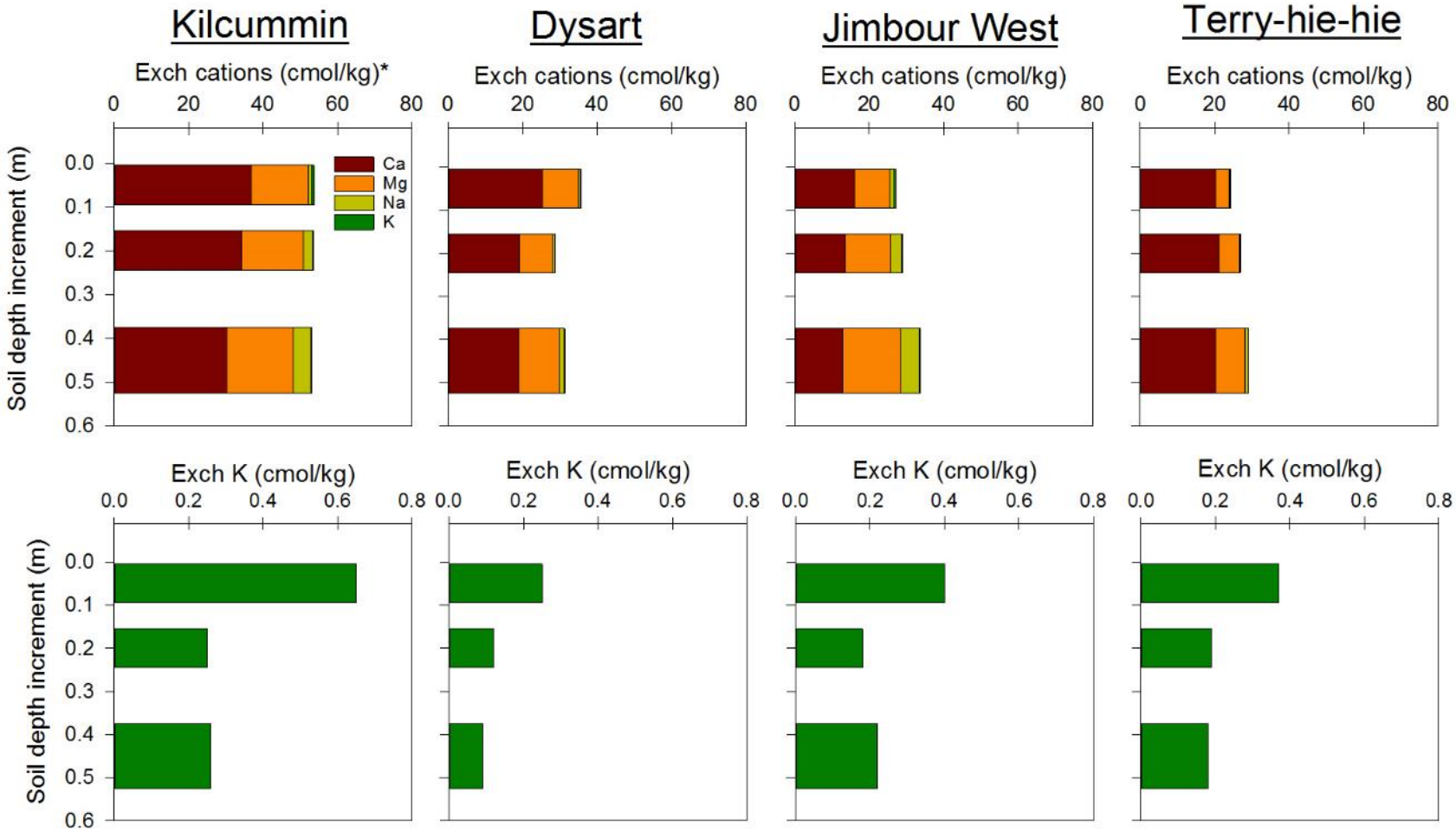
Pan evaporation



Growing conditions summary

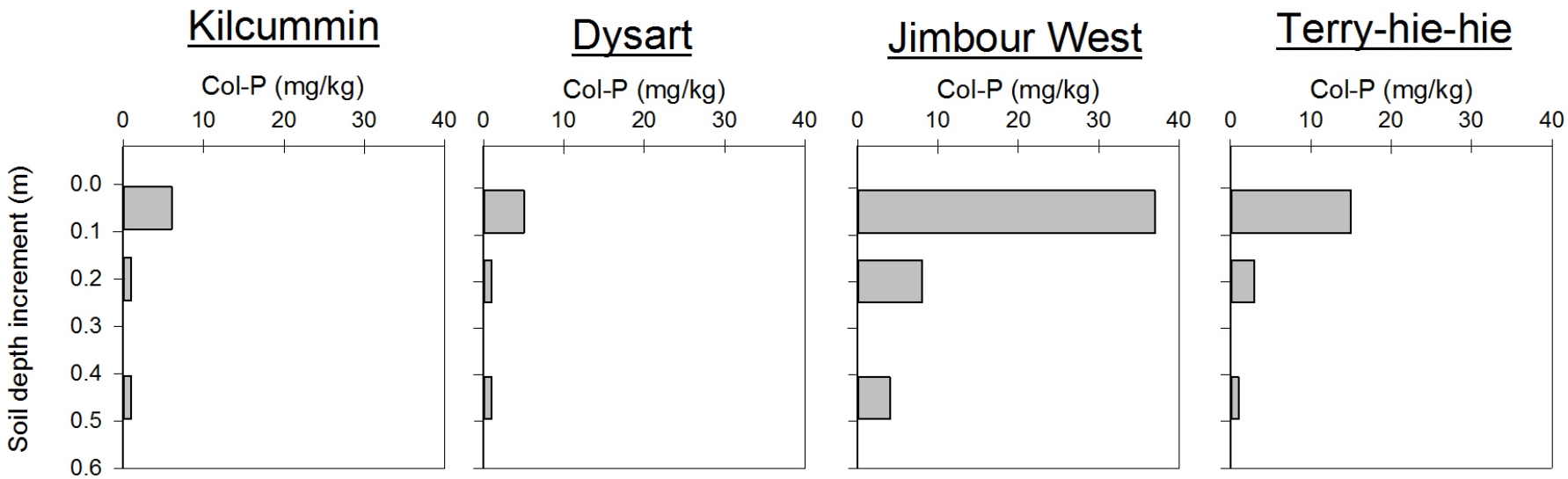
- Soils with high water holding capacity (150-250 mm)
- Cropping driven by moisture storage
- High evaporative demand (annual 1800-2400 mm)
- Large growing season rainfall variability (annual rainfall 550-750 mm)

Profile Exch Cation Distribution



* Ammonium acetate extractable

Profile Available P Distribution



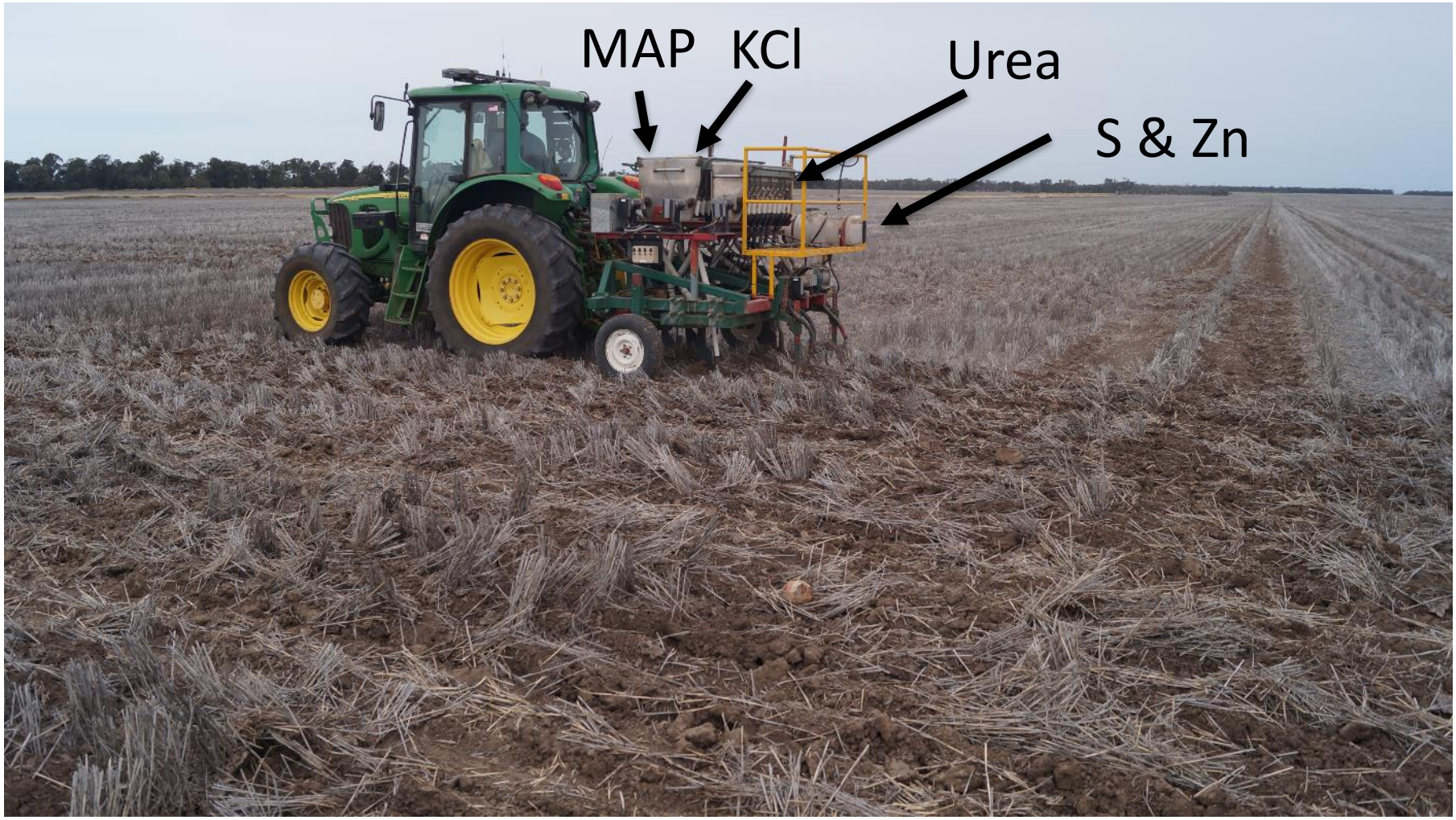
Hypothesis

More potential for immobile nutrient recovery if placed below 15 cm deep

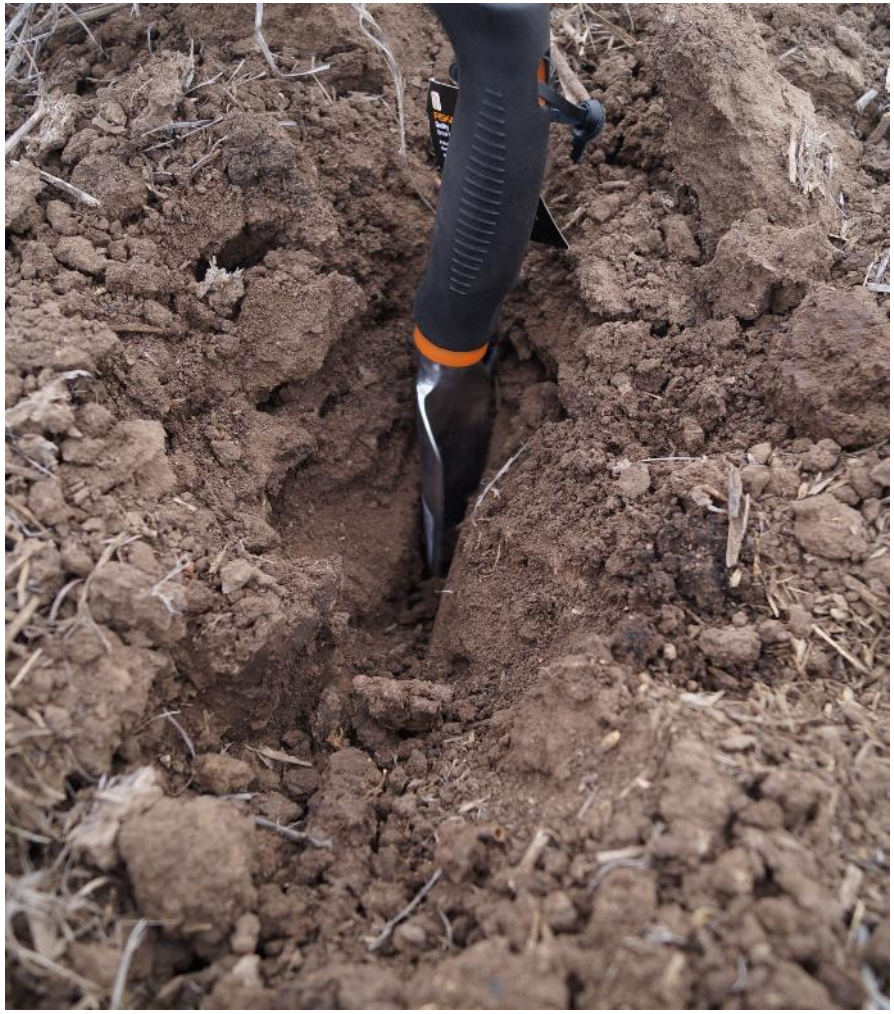
Experimental treatments

- Untreated control “Farmer Reference”
- 0, 25, 50, 100 kg K/ha + 20 kg P/ha
- 0, 100 kg K/ha without P
- K as KCl; P as MAP
- Basal N, S and Zn (balanced)
- 0.20+/-0.05 m depth
- 0.5 m row spacing
- Applied early fallow; grower sown

Treatment applicator



Treatment position



Results

- Full details in proceedings (O301)
- 8 sites; 14 site years
- Contrast site overview here

Dysart Yield results

Treatment results are the change in yield from the FR treatment

Year	FR	0K-P	100K-P	0K+P	25K+P	50K+P	100K+P	LSD (P<0.05)
13-14 Sg	3178	210	269	556	785	849	792	123

Year 1 Sorghum (2013-14):

- Tillage &/or basal nutrient effect [FR vs 0K-P]
- No K effect without P [0K-P vs 100K-P]
- With P, K increase yield

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Year 2 Sorghum (2014-15):

- Tillage &/or basal effect is diminished, No K effect without P
- With P (at depth), K increase yield (incremental effect)

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14-15 Sg	2966	114	96	329	434	641	576	124
15-16 Sg	2533	-31	68	108	447	271	197	290

Year 1 Sorghum (2013-14):

- Tillage &/or basal nutrient effect [FR vs 0K-P]
- No K effect without P [0K-P vs 100K-P]
- With P, K increase yield

Year 2 Sorghum (2014-15):

- Tillage &/or basal effect is diminished, No K effect without P
- With P (at depth), K increase yield (incremental effect)

Year 3 Sorghum (2015-16):

- All effects diminished
- Site ran out of nitrogen

Dysart K uptake (kg K/ha)

Year	FR	0K-P	100K-P	0K+P	25K+P	50K+P	100K+P	LSD (P<0.05)
13-14 Sg	50	50	73	55			82	
14-15 Sg								
15-16 Sg								

Kilcummin

Year	FR	0K-P	100K-P	0K+P	25K+P	50K+P	100K+P	LSD (P<0.05)
15 Cp	1765	49	-7	391	414	532	577	130

<u>Year 1 (Chickpea):</u>

- No Tillage &/or basal nutrient effect
- No K effect without P
- With P (at depth), K increase yield (incremental effect)

Terry-hie-hie

Year	FR	0K-P	100K-P	0K+P	25K+P	50K+P	100K+P	LSD (P<0.05)
13-14 Ct	239	11	118	44	80	128	176	38
15 Wh	4167	148	106	-88	131	50	31	NS

Year 1 (Cotton):

- No Tillage &/or basal nutrient effect, or P effect
- K increase yield, but very drought affected crop

Year 2 (Wheat):

- Better than average growing season
- No effect to any treatment
- More southerly growing zone

Conclusions

For high evaporative, stored moisture systems:

- Yield can be increased through deep co-location of K and P, but
- Site x season x species interaction
- Other nutrient constraints (N)
- Work continuing to explore these.