The Effect of Soil Moisture on Fluid and Granular Fertilizer Availability.

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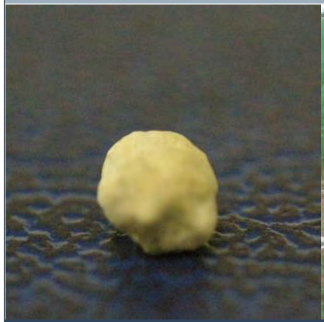


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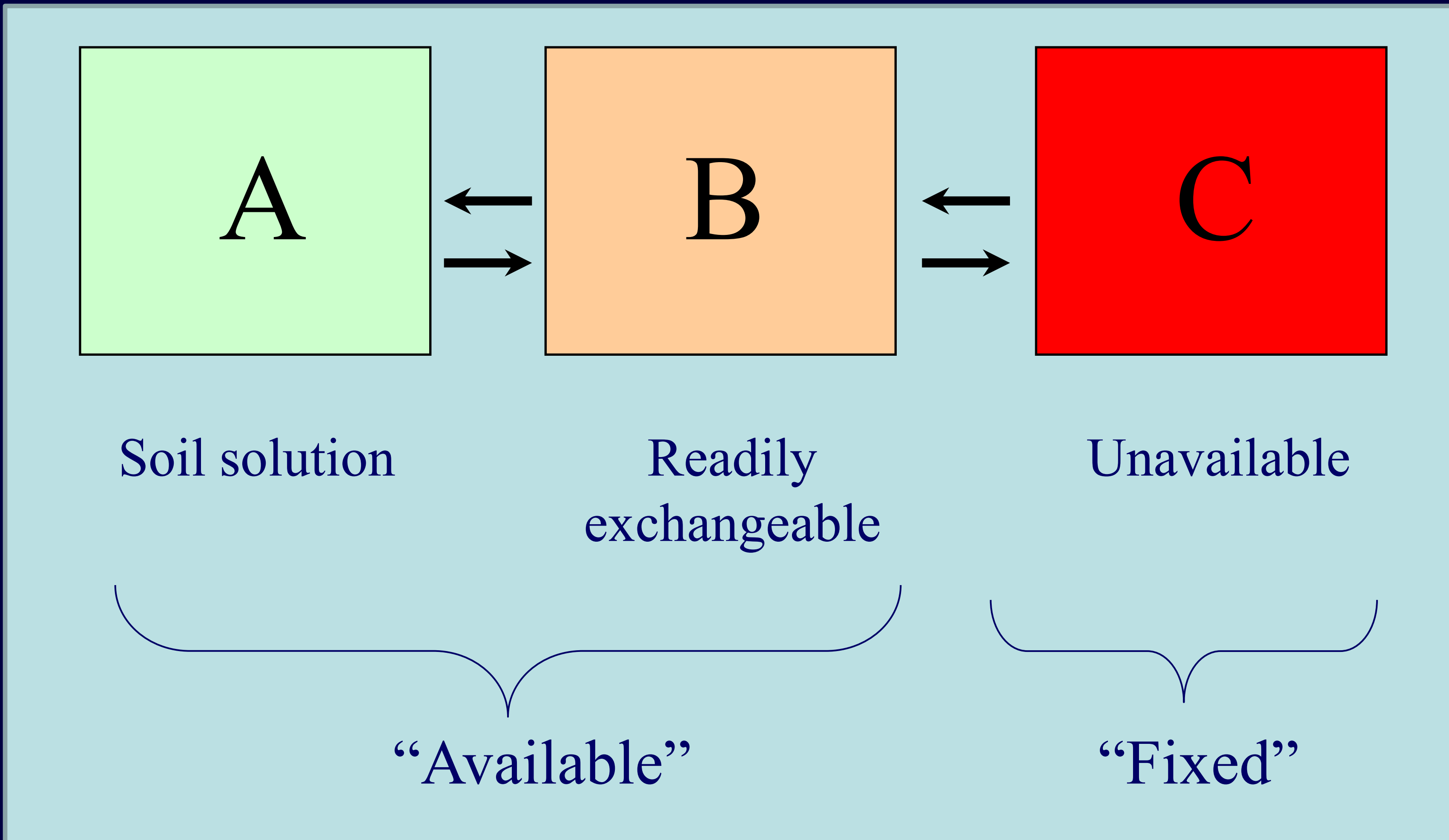
Outline

- Soil Moisture x Nutrient Interactions
- Experimental Design
- Results
- Conclusions
- Further work
- Acknowledgements

Soil Moisture x Nutrient Interactions



Farmer Perspective

Key Project Questions

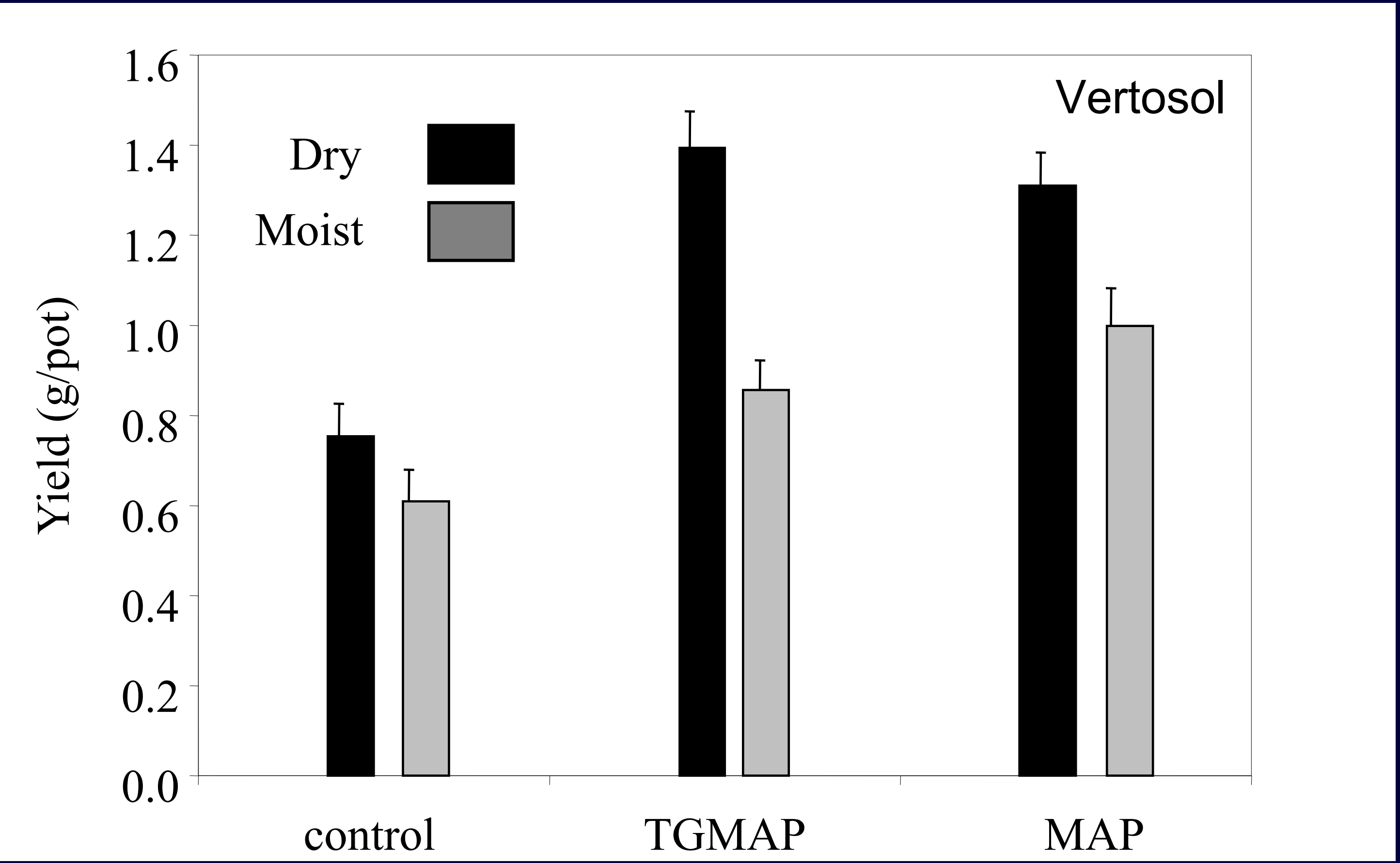
- Is there carryover of fertilizer nutrients after drought?
- Can fertilizer rates be reduced following drought?

Both questions relate to diffusion and fixation reactions of fertilizer in response to soil moisture.

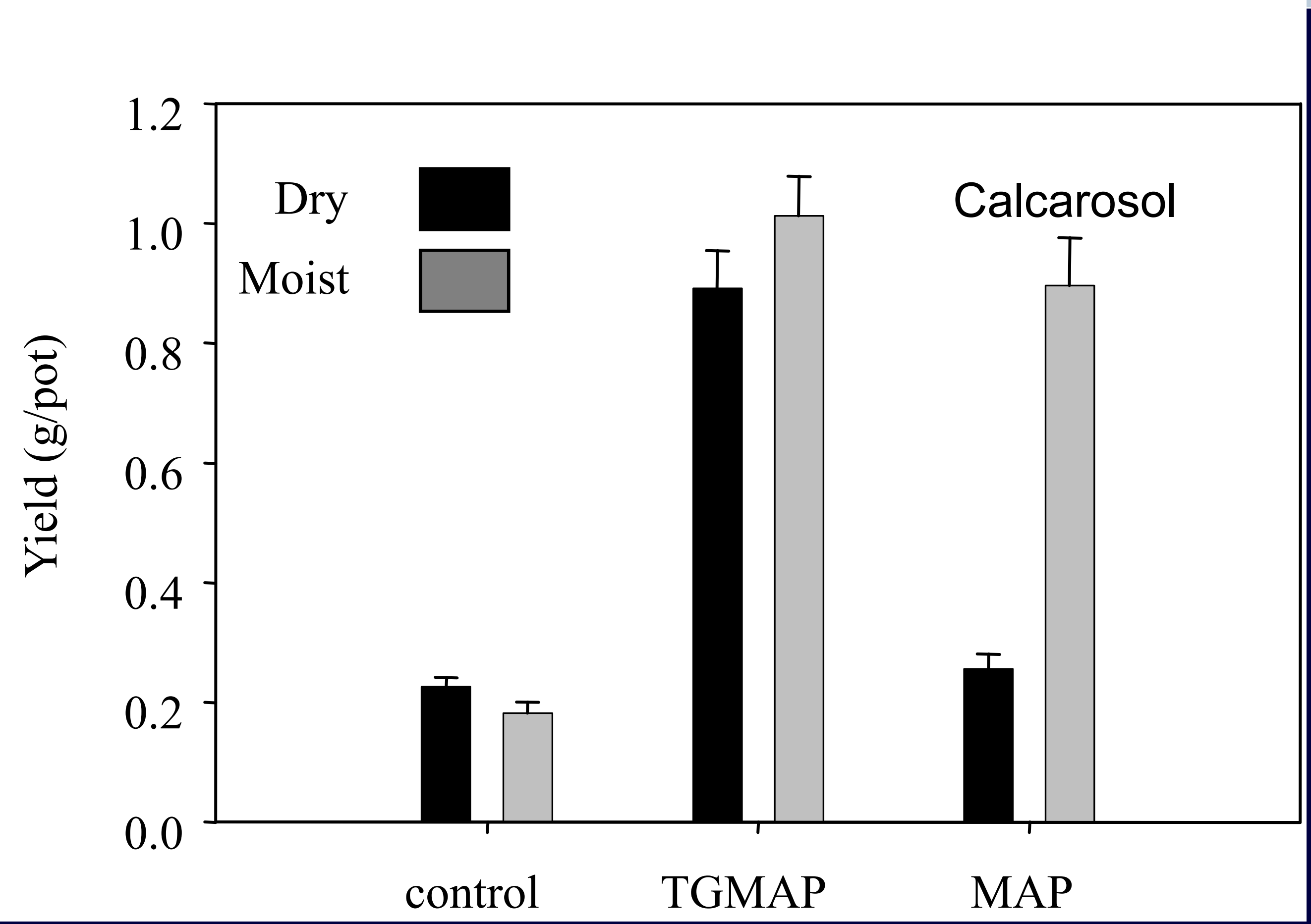
Soil Moisture x Nutrient Interactions

What do we know about fertilizer behaviour under drought conditions?

- Reduced dissolution of fertilizer
- Reduced root growth, hence reduced nutrient uptake efficiency
- Reduced diffusion of fertilizer ?
- Reduced fixation of fertilizer ?



In clay soil dry incubation increased the amount of fertilizer available for plant growth.



In calcareous soil dry incubation decreased the amount of granular fertilizer available for plant growth.

Soil Moisture x Nutrient Interactions

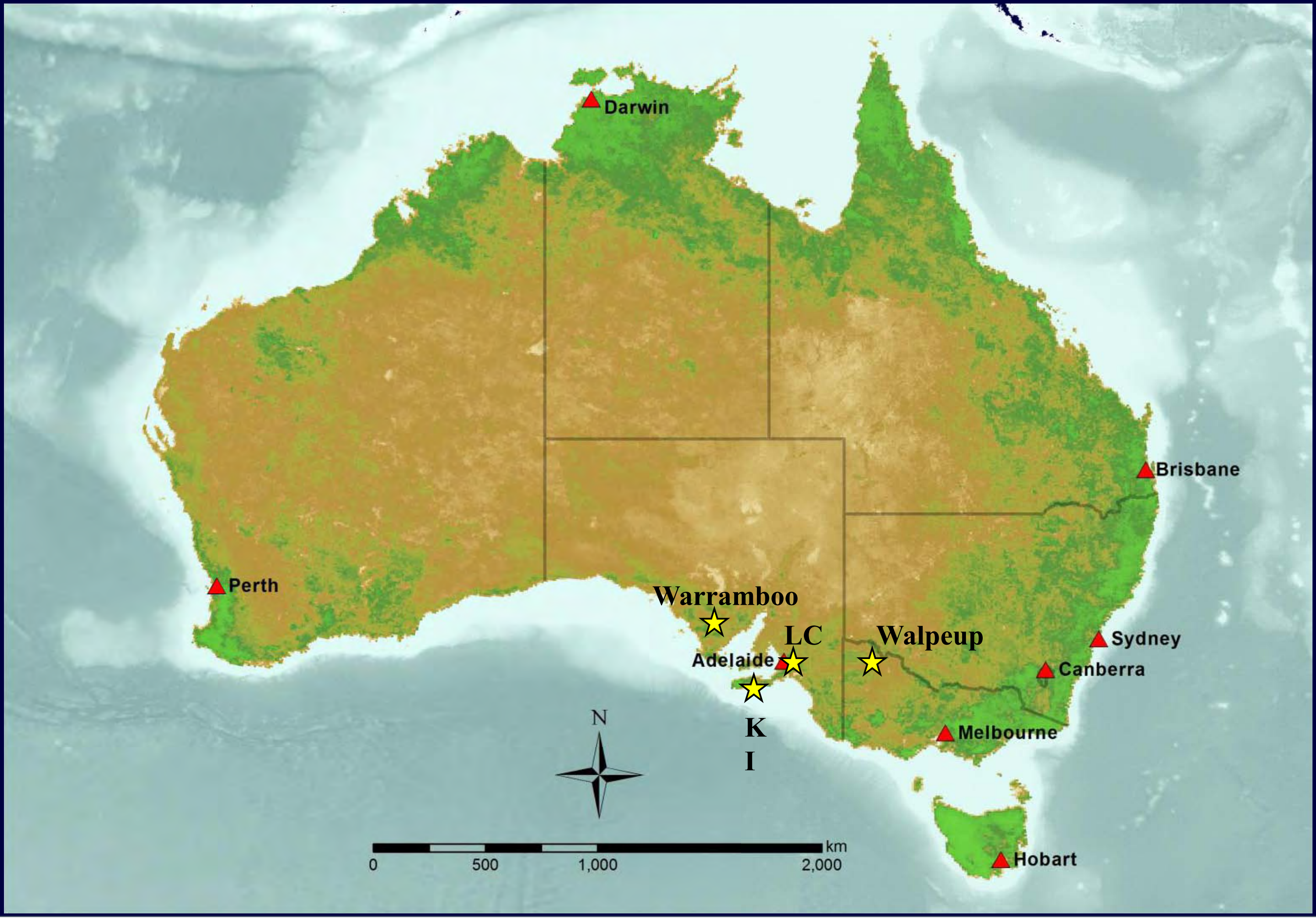
To manage drought farmers often sow early into dry soil.

- How does this affect nutrient availability?
- May also give some clues as to nutrient availability following dry spells.

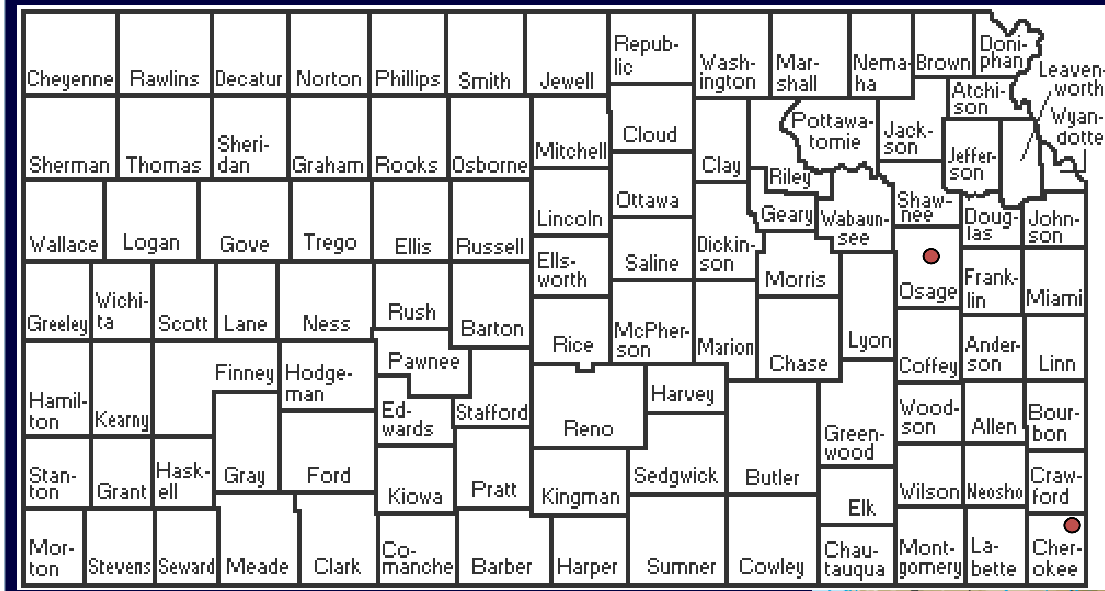
Experimental Design

- Soils-Langhorne Creek, Walpeup, Kangaroo Island, Osage, Wary, Warramboo.
- Fertilizers- Fluid and Granular P and Zn.
- Moisture- Air Dry and 80% field capacity incubation for 4 weeks.

Australian Sites



US Sites


Cheyenne
Rawlins
Decatur
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Phillips
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Repub-lic
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Sherman
Thomas
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Ottawa
Wallace
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Russell
Lincoln
Geary
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Shaw-nee
Doug-las
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Dickin-son
Ells-worth
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Morris
Osage
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Miami
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Chase
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Harvey
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Bour-bon
Stan-ton
Grant
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Gray
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Kiowa
Pratt
Kingman
Sedgwick
Butler
Elk
Wilson
Neosho
Craw-ford
Mor-ton
Stevens
Seward
Meade
Clark
Co-manche
Barber
Harper
Sumner
Cowley
Chau-tauqua
Mont-gomery
La-bette
Cher-okee


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Florida
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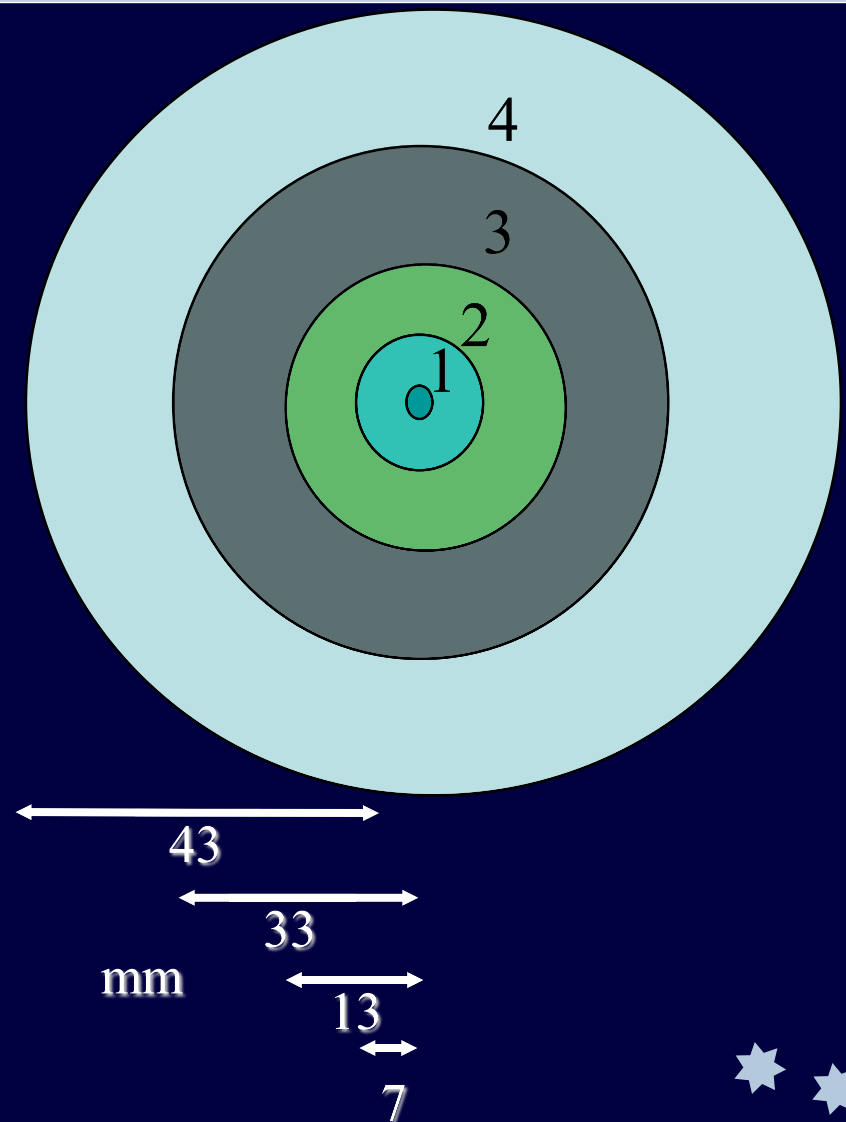
Maine
New York
Alaska
Hawaii

Soils

Test	Units	Kangaroo Island	Walpeup	Langhorne Creek	Warramboo	Osage	Wary
pH	H_2O	5.9	7.6	8.3	8.3	6.0	6.0
Texture		Loamy sand	Sandy Loam	Sandy Loam	Loamy Sand	silt loam	silt loam
Total Ca	mg/kg	5602	1742	15524	245536	2598	1145
Total Fe	mg/kg	12024	9137	13867	3680	17450	99242
Total Al	mg/kg	25379	14935	15524	4830	21121	942952
Total P	mg/kg	537	89	506	343	310	360
DGT CE_P	µg/L	135	197	151	354	618	739
Total Zn	mg/kg	27	25	21	27	50	34

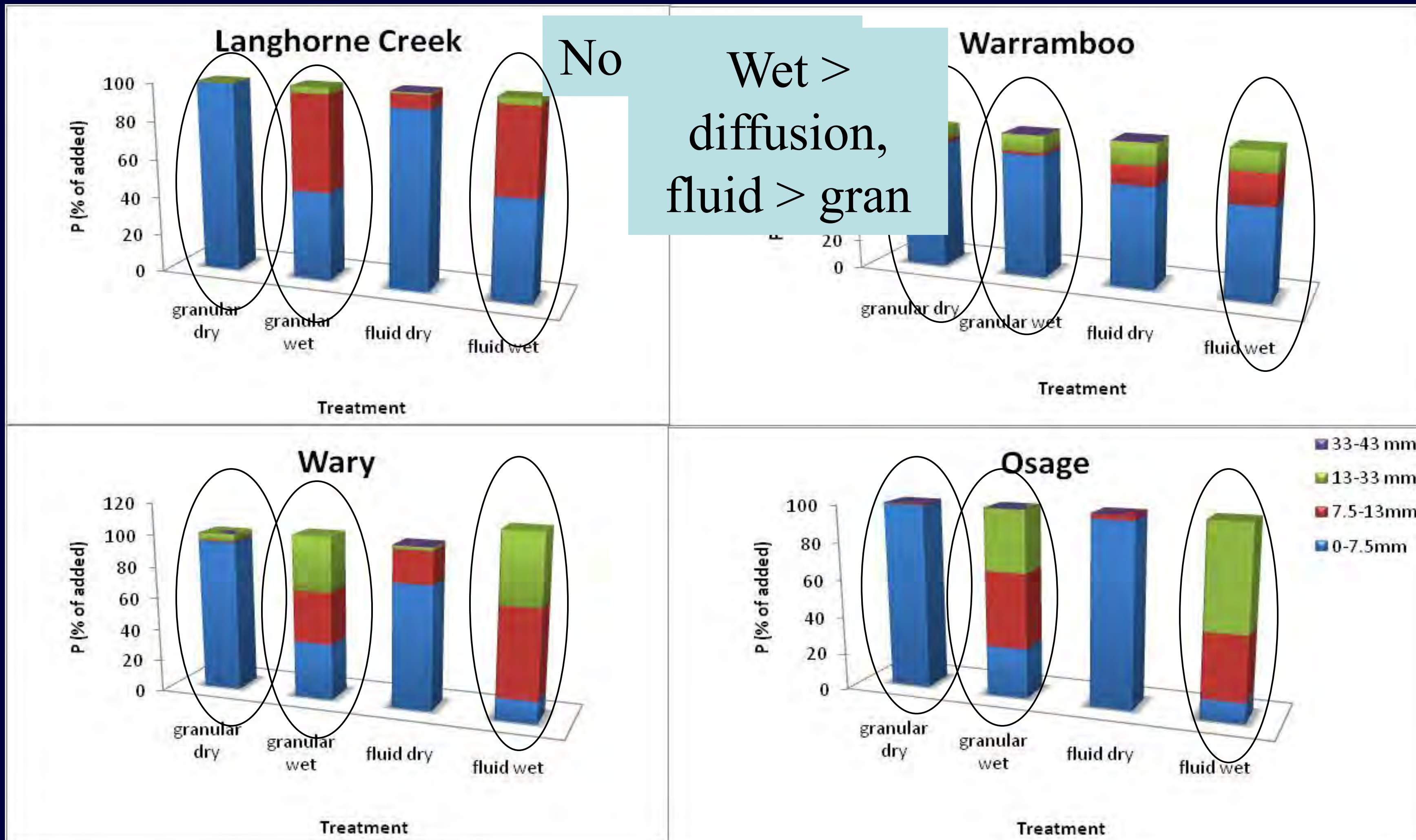
Experimental Design

6 soils
2 ferts (TGMAP + Zn, MAP Zn coated)
2 moistures (air dry / 80% field capacity)
3 reps
Sampled in 4 sections



- pH
- Total P/Zn
- Water soluble P/Zn
- Soil Labile P/Zn (E-values)

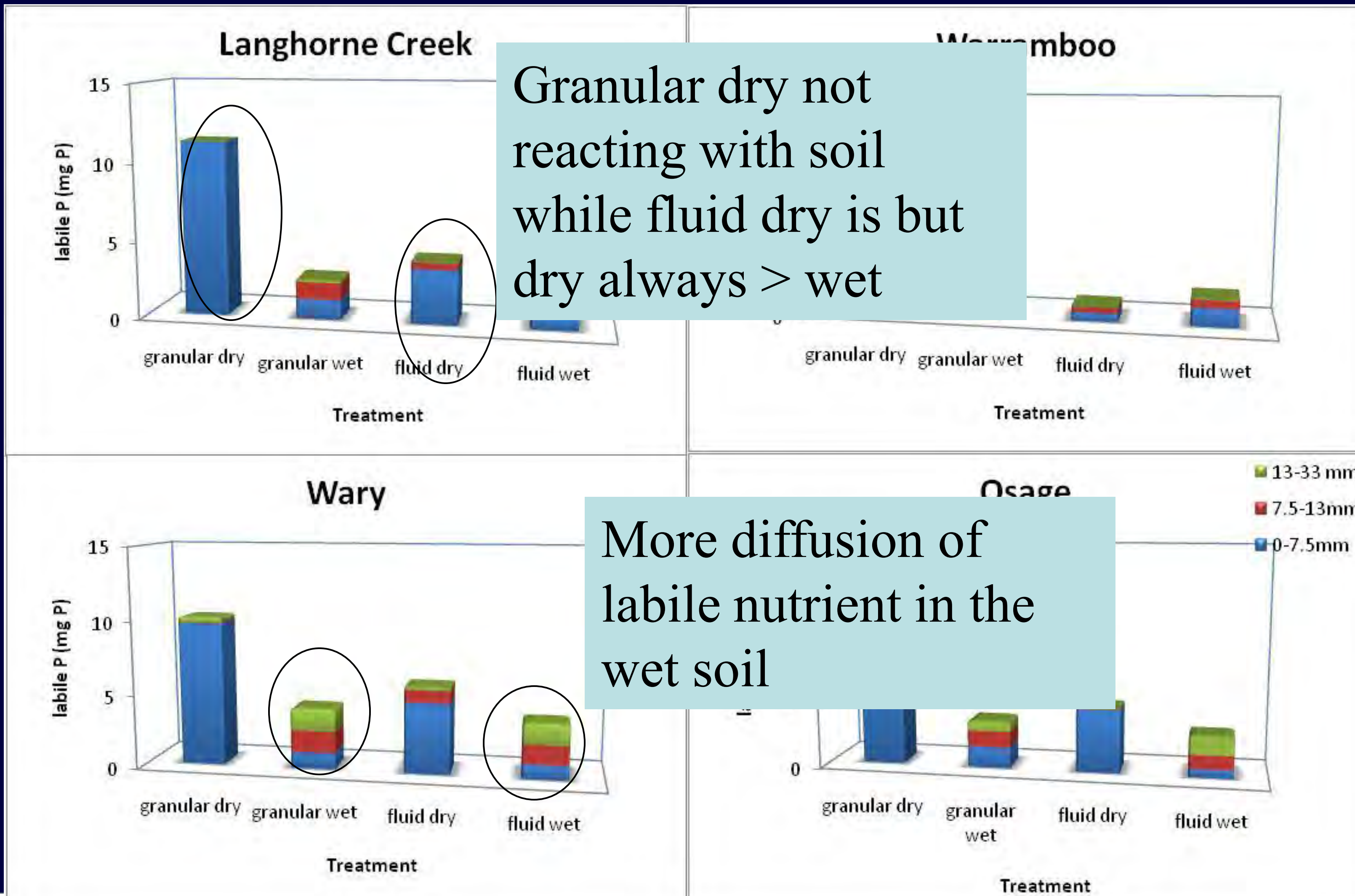
Phosphorus Diffusion



Phosphorus Diffusion

- In wet and dry soil fluid fertilizer diffusion greater than granular.
- In dry soil most of the P added does not move beyond the zone of application.

Phosphorus Lability



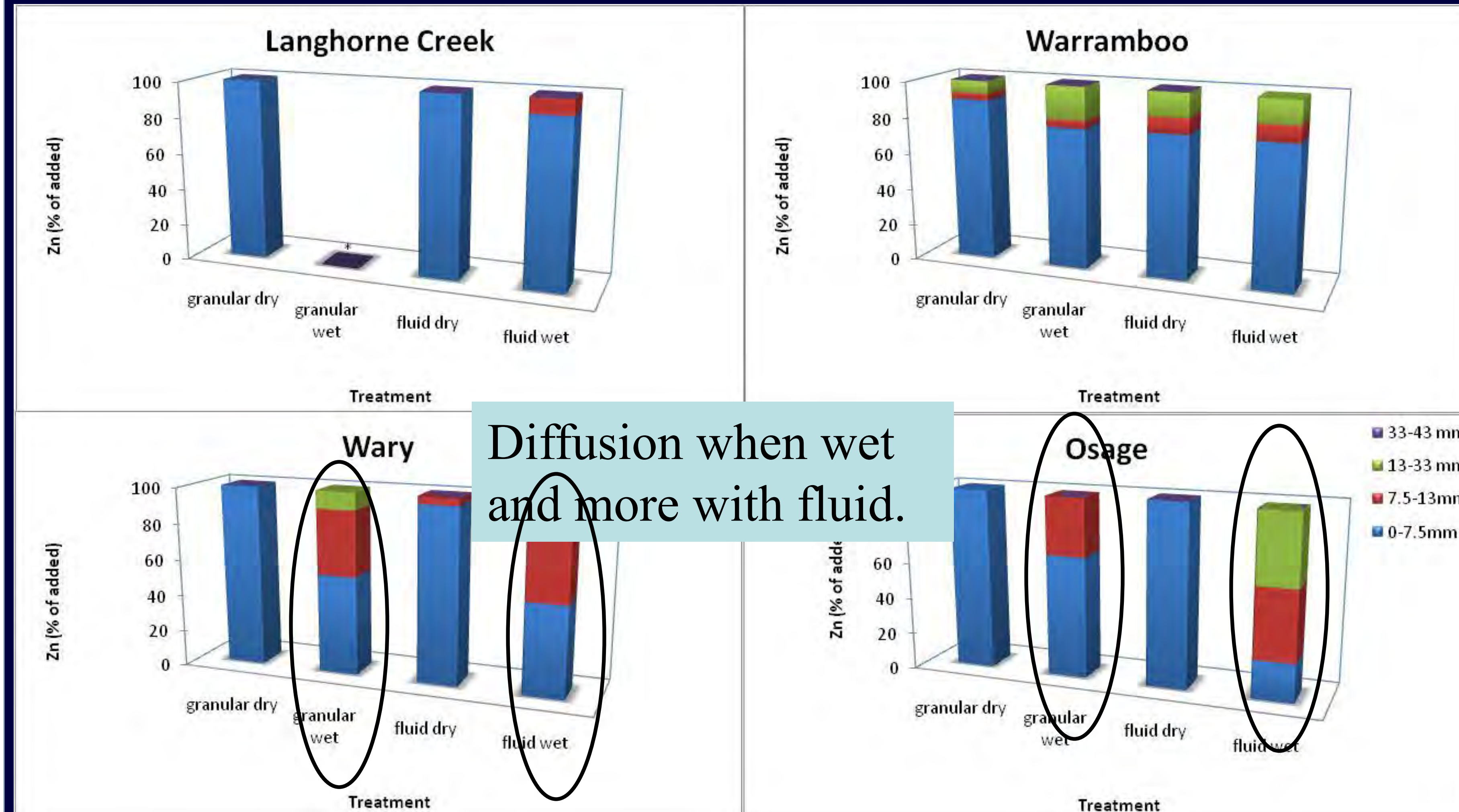
Granular dry not reacting with soil while fluid dry is but dry always > wet

More diffusion of labile nutrient in the wet soil

Phosphorus Lability

- In dry soil the granular fertilizer does not interact with the soil while fluid fertilizer does decreasing its lability.
- Soil incubated dry has greater amount of labile P in almost all cases (exception Warramboo).
- In wet soil there is more diffusion of labile P.

Zinc Diffusion

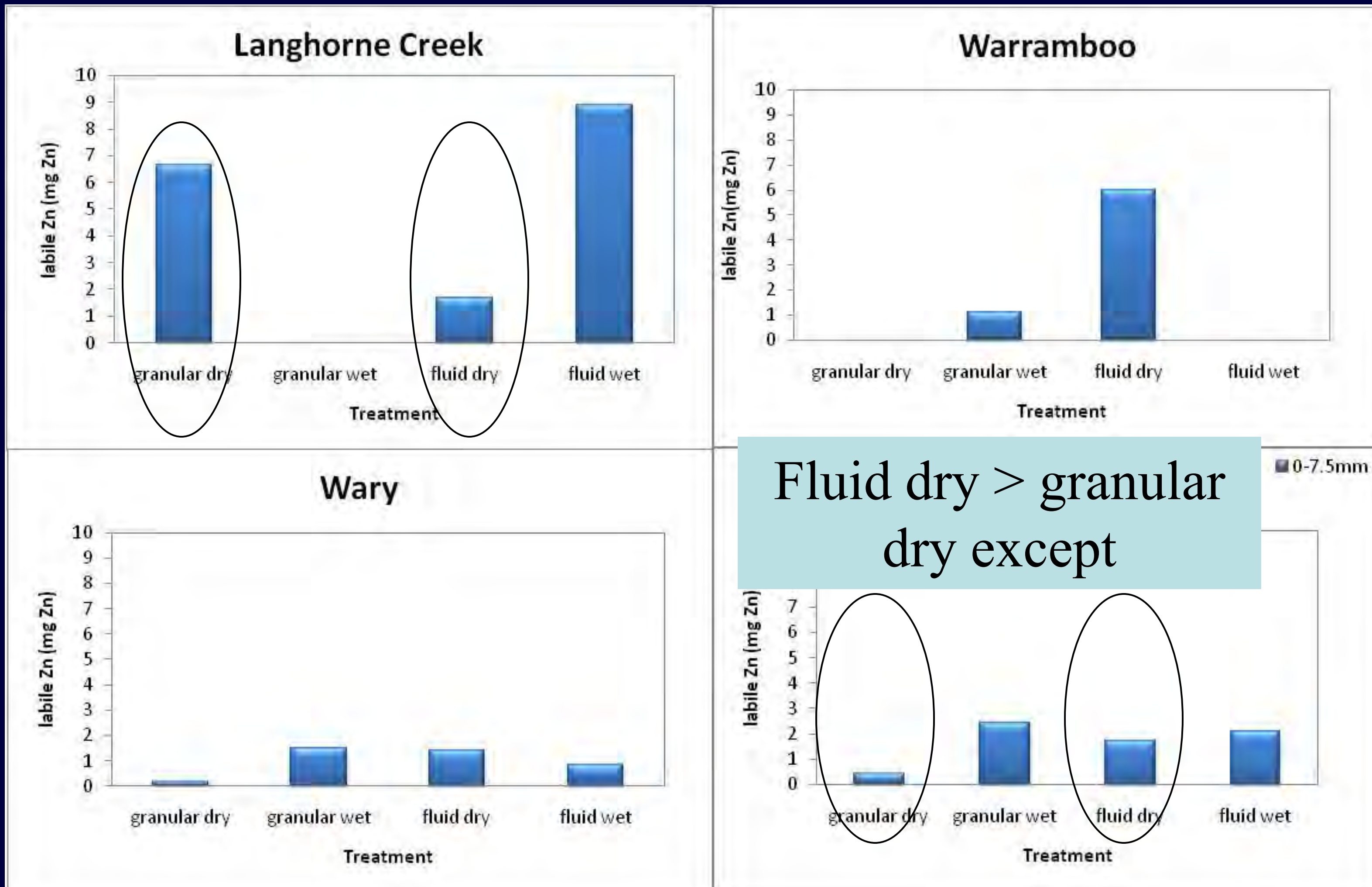


Diffusion when wet and more with fluid.

Zinc Diffusion

- More Zn diffusion in wet soil and with fluid fertilizer
- In dry soil most of the Zn added does not move beyond the zone of application

Zinc Lability

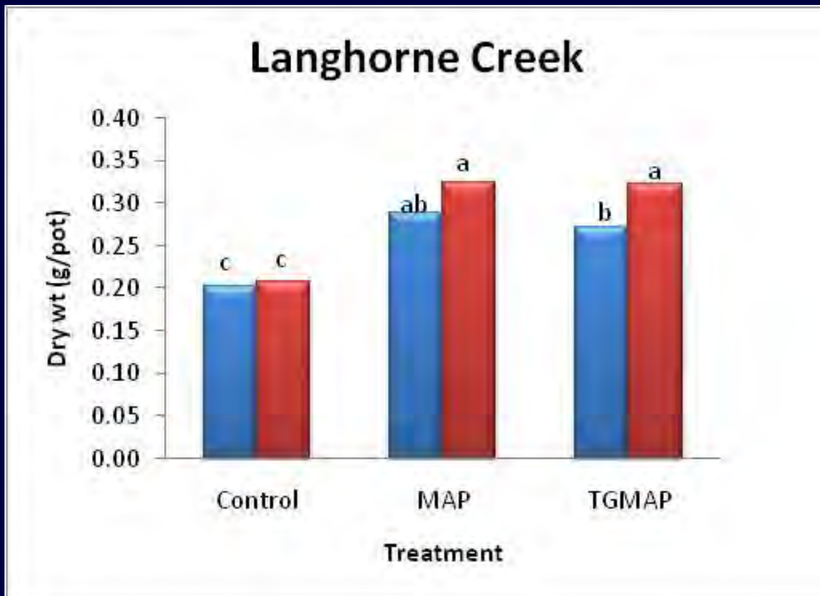


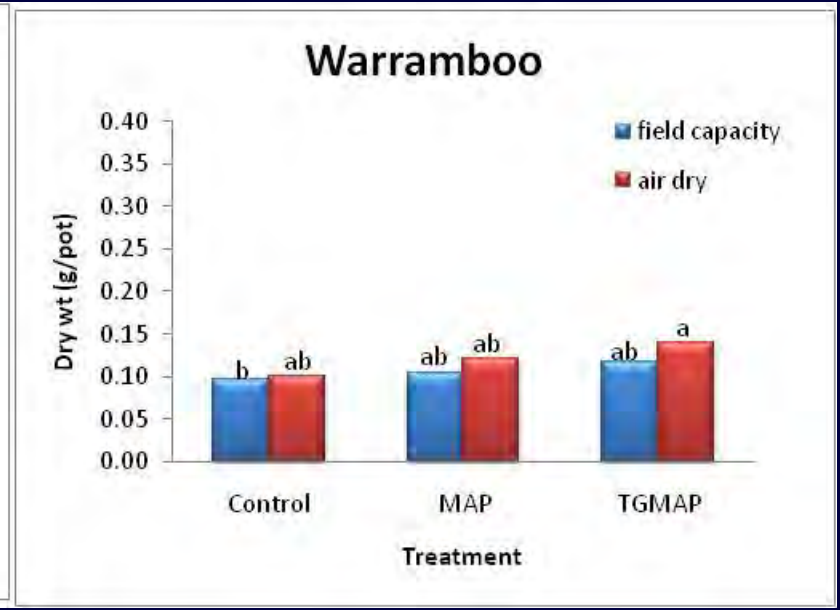
Fluid dry > granular dry except

Zinc Lability

- More labile Zn from fluid than from granular in dry soil in ¾ cases.
- Each soil and fertiliser combination different as to whether wet > dry.
- Issues of detection for Zn are currently being refined.

Plant growth after wet and dry incubation





- LC better plant response to dry than to wet (esp. TGMAP).
- Warramboo soil fresh batch and much less responsive.

Conclusions

- Diffusion of both fluid and granular P and Zn are inhibited when incubated dry.
- Labile P was higher at the point of application when incubated dry.
- Labile Zn was higher in dry soil when added as a fluid.
- Fluid P added to dry soil had < lability than granular- important when contemplating dry sowing.

Further Work

- Comparison of these results with field studies.
- The effect of a range of wet-dry cycles on diffusion and lability.
- The effect of co-location vs. separately applied Zn and P.
- The effect of granular fertilizer coating on diffusion and lability.

Acknowledgements

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