



Department of
Primary Industries and
Regional Development



LESSONS LEARNT FROM SOIL AMELIORATION BLOOPERS

B Isbister, W Parker, G McDonald, G Azam, S Davies



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GRAINS RESEARCH
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CORPORATION



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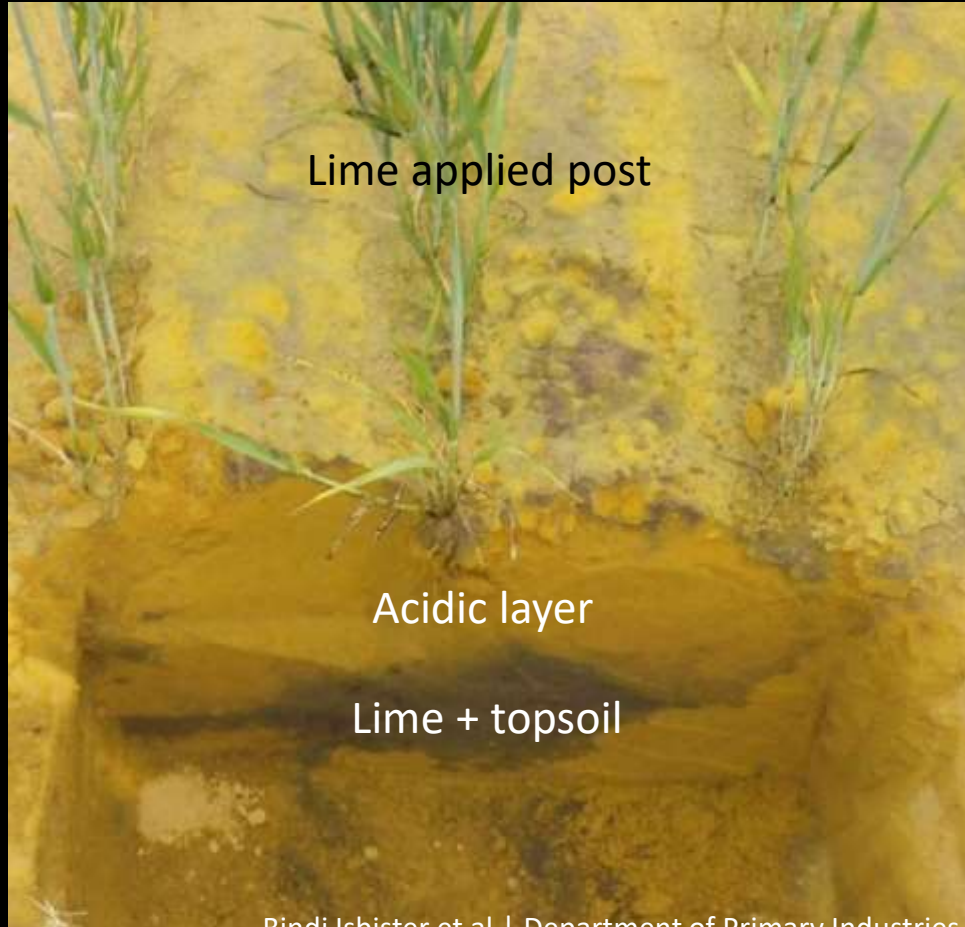


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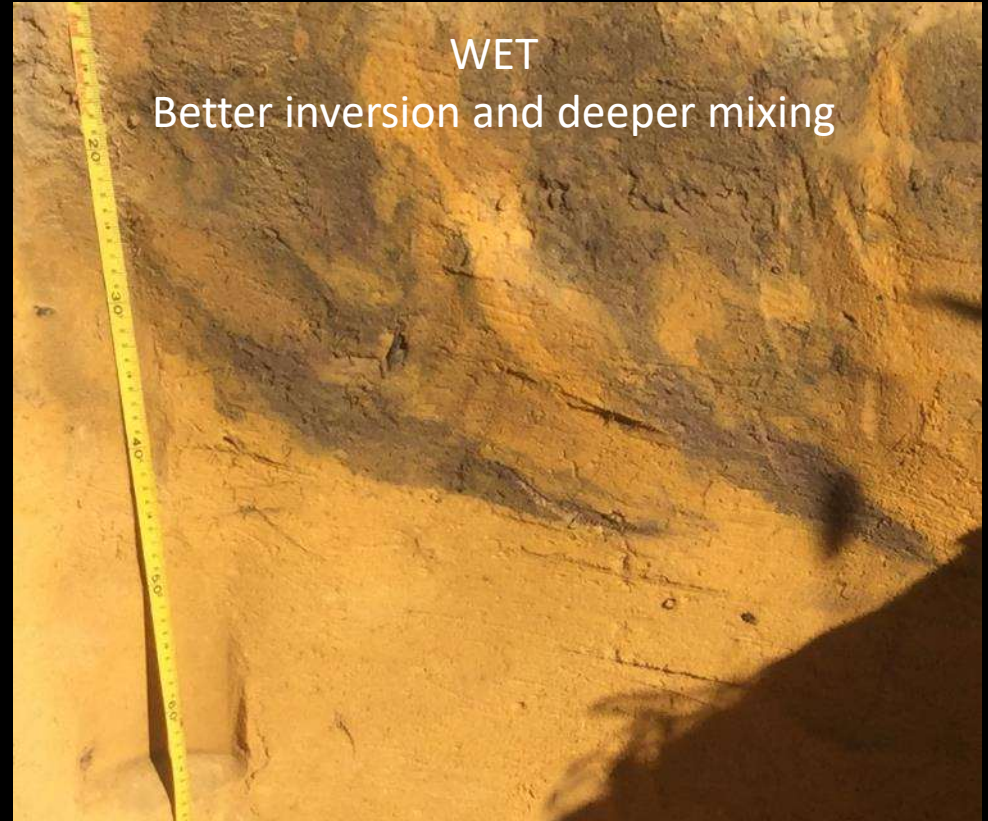
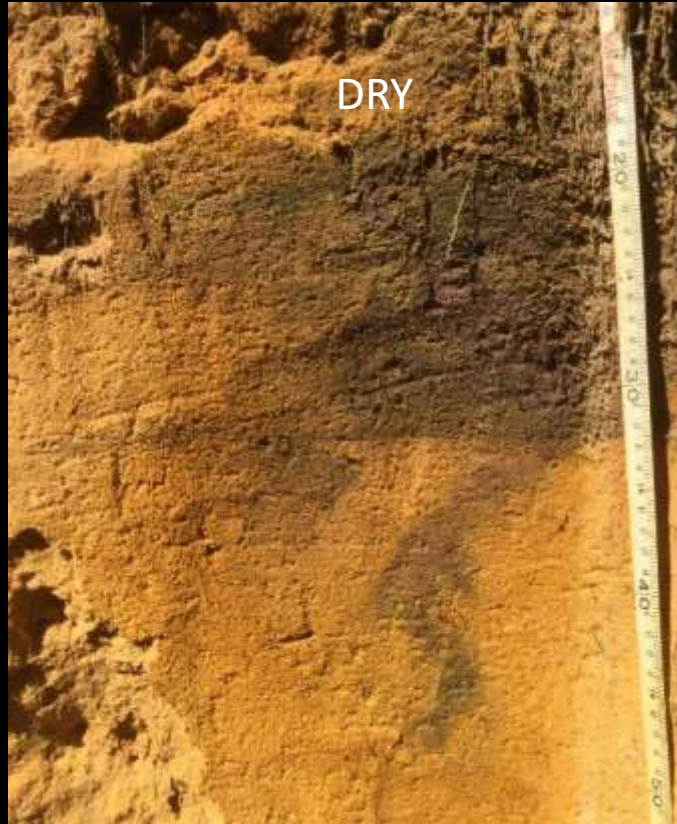
Be careful with pre-emergent herbicides post amelioration



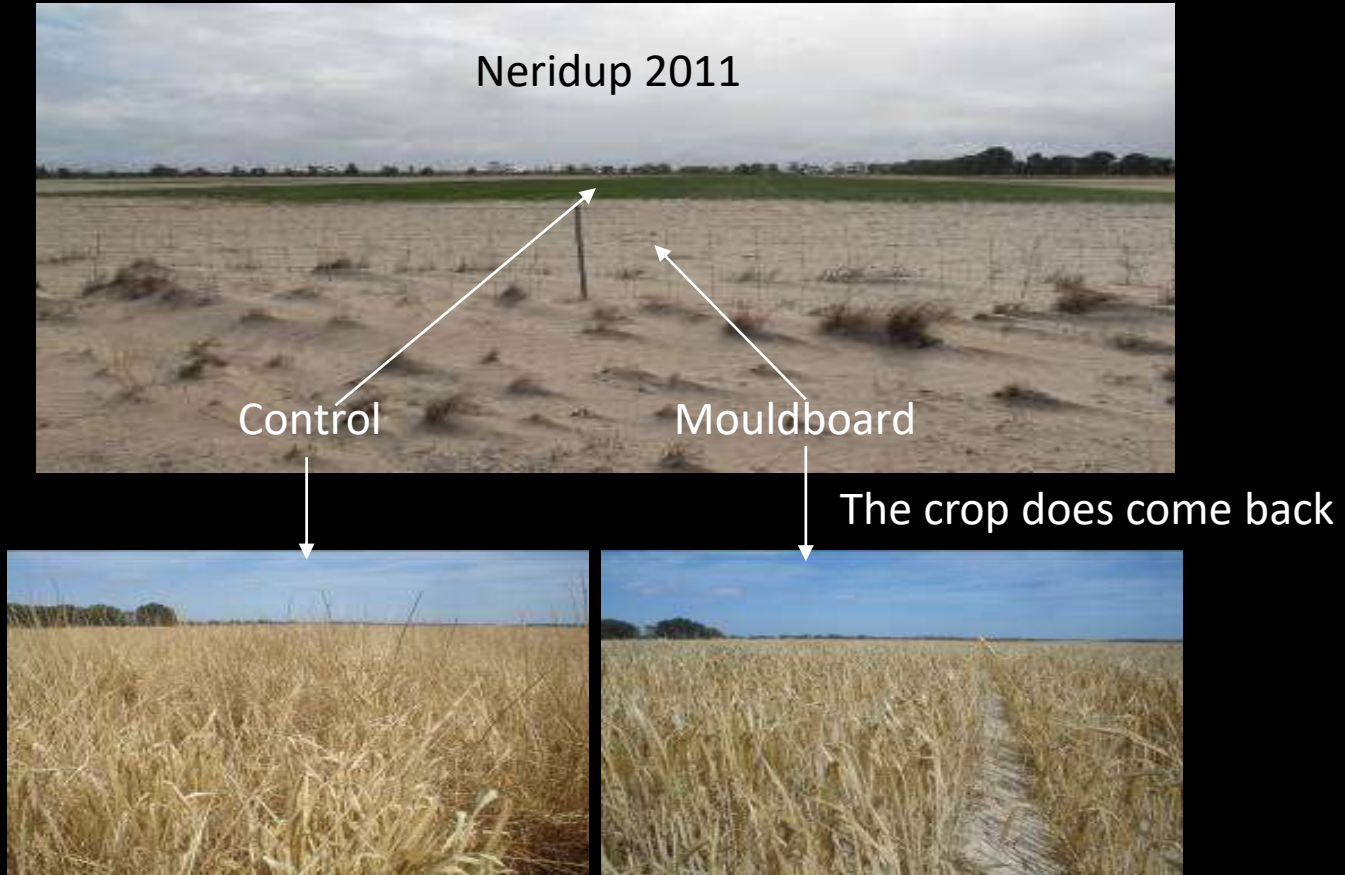
Mouldboarding can turn up acid soil



Mouldboarding or spading dry isn't as good as wet



The risk of erosion is greater in autumn



October is too late to mouldboard and establish a cover crop as greater risk of no follow up rain



Poor sand didn't establish

It can be too wet for ripping

If you can roll a soil “sausage” there
is no point to ripping



Deep ripping a sodic, dispersive, calcaerous earth leaves a cloddy surface



Too dry to be effective



No wheat yield benefit of deep ripping calcaerous earth



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		2018		2019
Topdress	Ripping depth (mm)	Emergence (plants/m ²)	Yield (t/ha)	Yield t/ha
Nil	Nil	98	2.92	1.79
	200	74	2.84	1.7
	300	74	2.84	1.71
Gypsum 5t/ha	Nil	98	2.89	1.73
	200	78	2.75	1.7
	300	76	2.8	1.66
Isd (10%)		NS	NS	NS

No wheat yield benefit of deep ripping calcaerous earth



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		2018		2019	Cumulative ROI 2018 + 2019 \$/ha
Topdress	Ripping depth (mm)	Emergence (plants/m ²)	Yield (t/ha)	Yield t/ha	
Nil	Nil	98	2.92	1.79	
	200	74	2.84	1.7	-2.1
	300	74	2.84	1.71	-1.5
Gypsum 5t/ha	Nil	98	2.89	1.73	-1.1
	200	78	2.75	1.7	-1.3
	300	76	2.8	1.66	-1.3
Isd (10%)		NS	NS	NS	

* Grain price \$350 /t, Costs R200 = \$56/ha, R300 = \$118, 5t Gypsum = \$215t/ha

Bloopers commonly occur
when the treatment is not
applicable for all soil types in a
paddock

Delving 10-60cm duplex soils can bring up too much clay.....



That is not good if its sodic, saline and high in boron



That is not good if its sodic, saline and high in boron



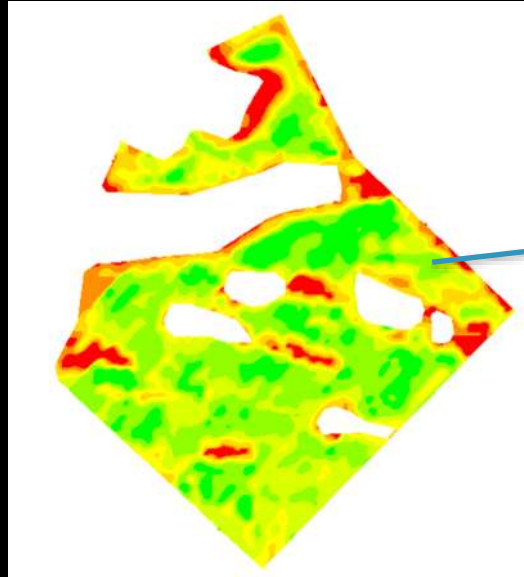
Delved Clay	EC dS/cm	pH	ESP %	B mg/kg	Clay %
Clay1	0.176	7.5	24.8	8	35
Clay2	0.423	8.7	29.2	10.3	54

10 yrs after treatment still can have a yield penalty

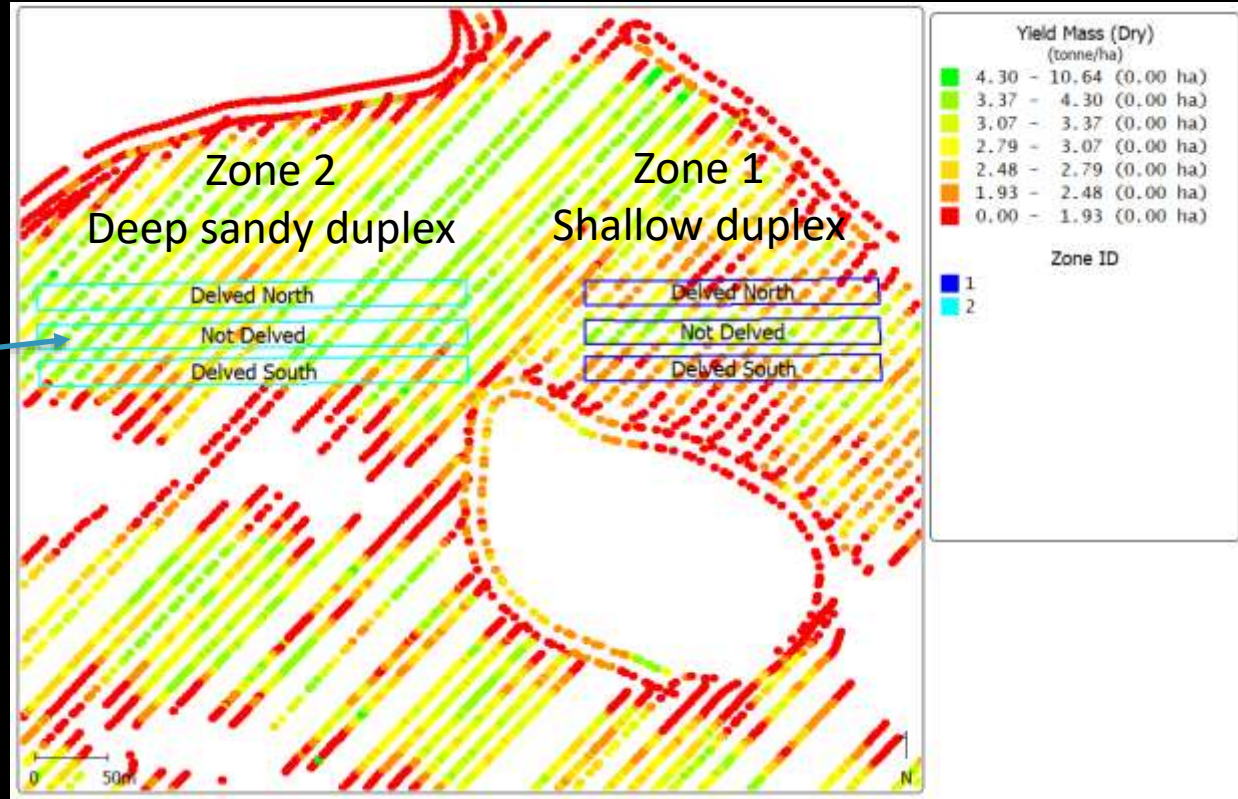


Post delving Applied gypsum & cultivated 10 times cost treatment \$500/ha

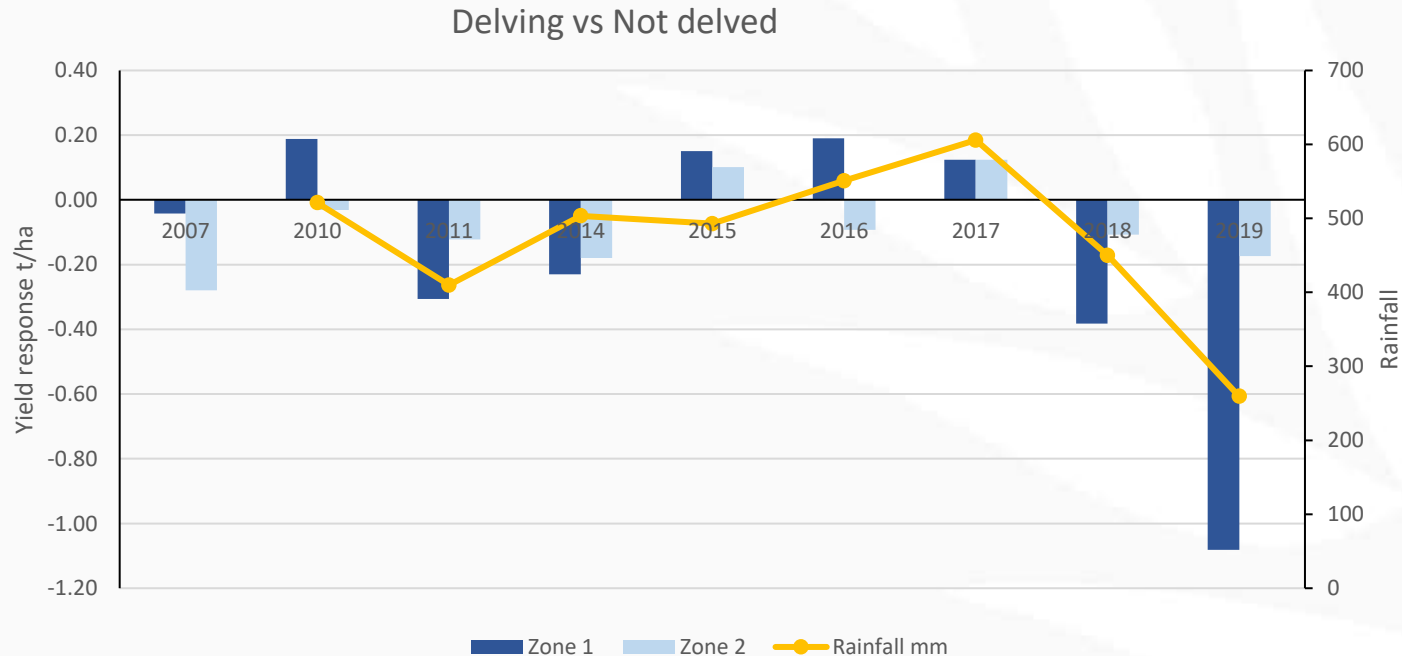
The penalty is not across the whole paddock



2019
2.3t



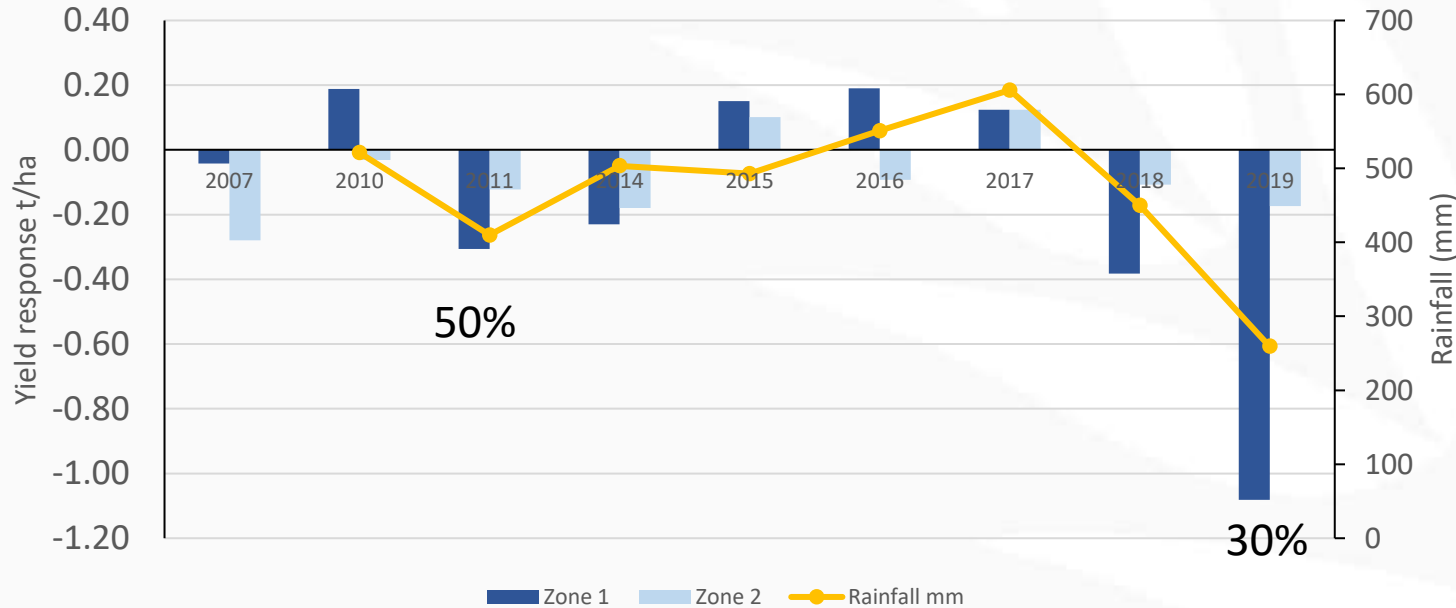
In dry years there was a yield penalty from delving



In dry years there was a yield penalty from delving vs no delving



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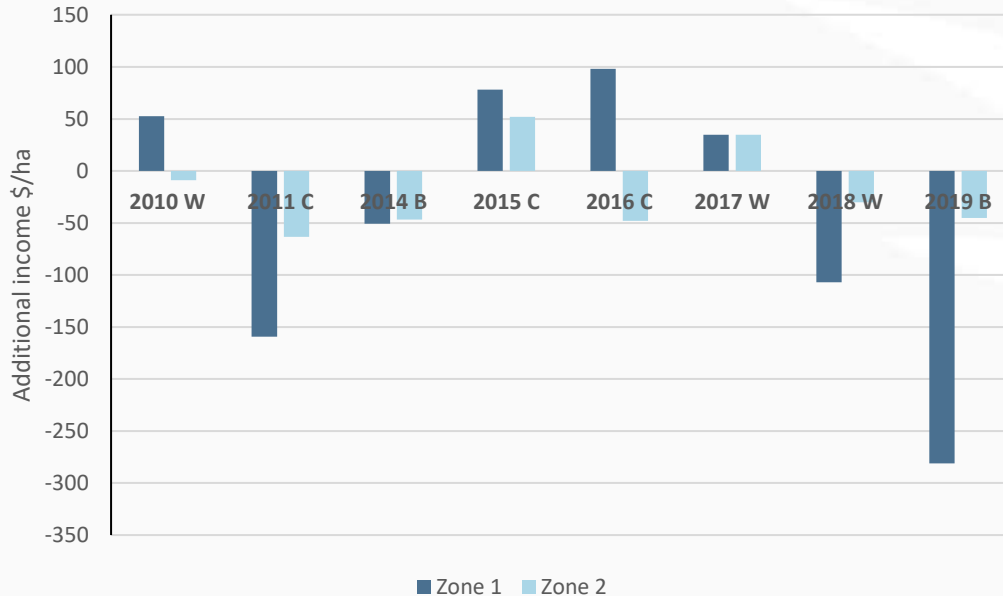
8 yr cumulative ROI delving vs no delving



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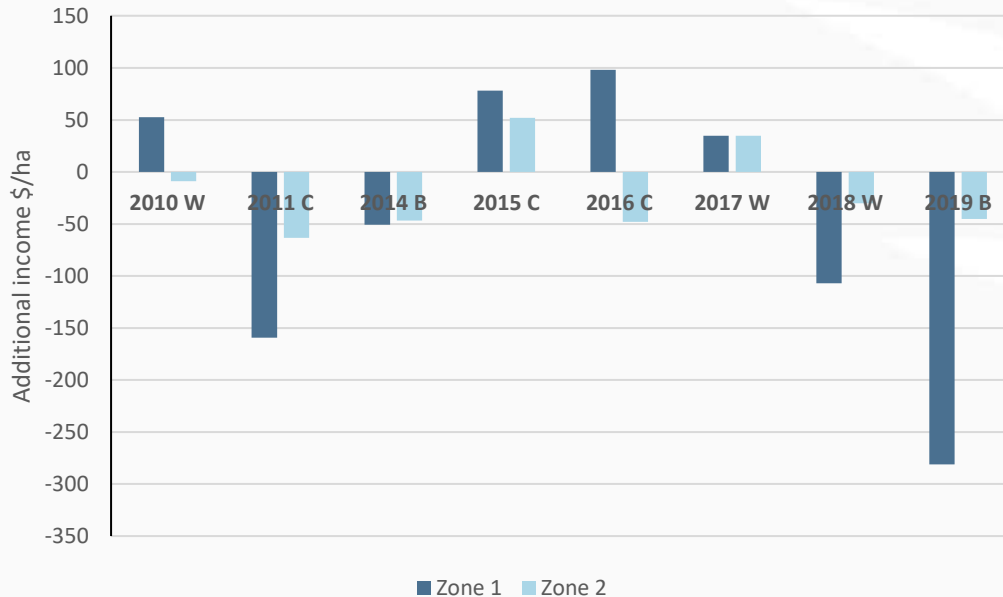


Costs Delving \$500, Grain price wheat \$280, canola \$520/t, barley \$260/t



8 yr cumulative ROI delving vs no delving

Costs Delving \$500, Grain price wheat \$280, canola \$520/t, barley \$260/t



$$\text{ROI} = \frac{(\text{additional } \$/\text{ha} - \text{treatment cost})}{\text{treatment cost}}$$

	Zone 1	Zone 2
Total additional income \$/ha	-335	-156
ROI \$/ha	-2	-1

SOLUTION


Bring up less clay (don't dig as deep) or spading was a safer option

Ameliorate by zone

- depth to clay maps using EM and Gamma didn't work because of salinity and moisture
- yield or biomass maps in dry seasons?

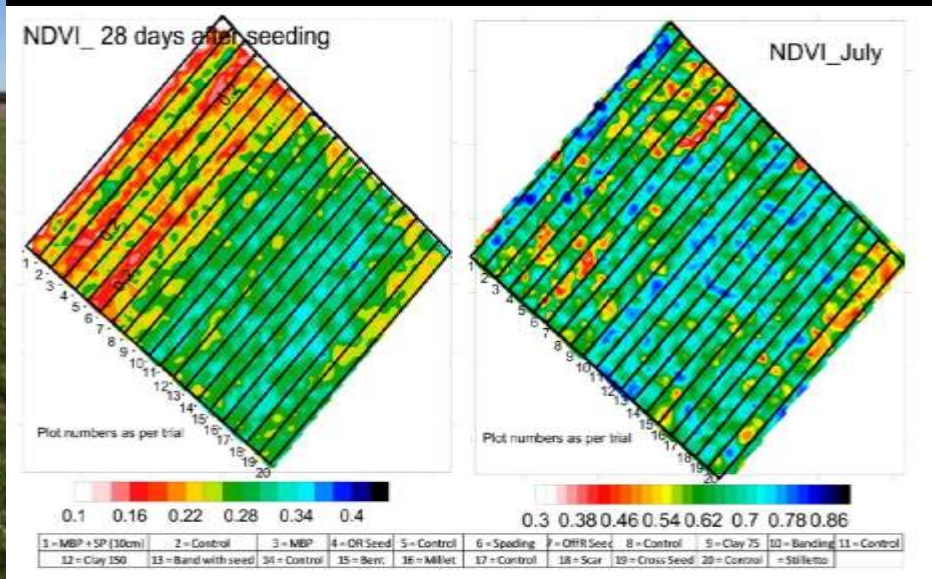
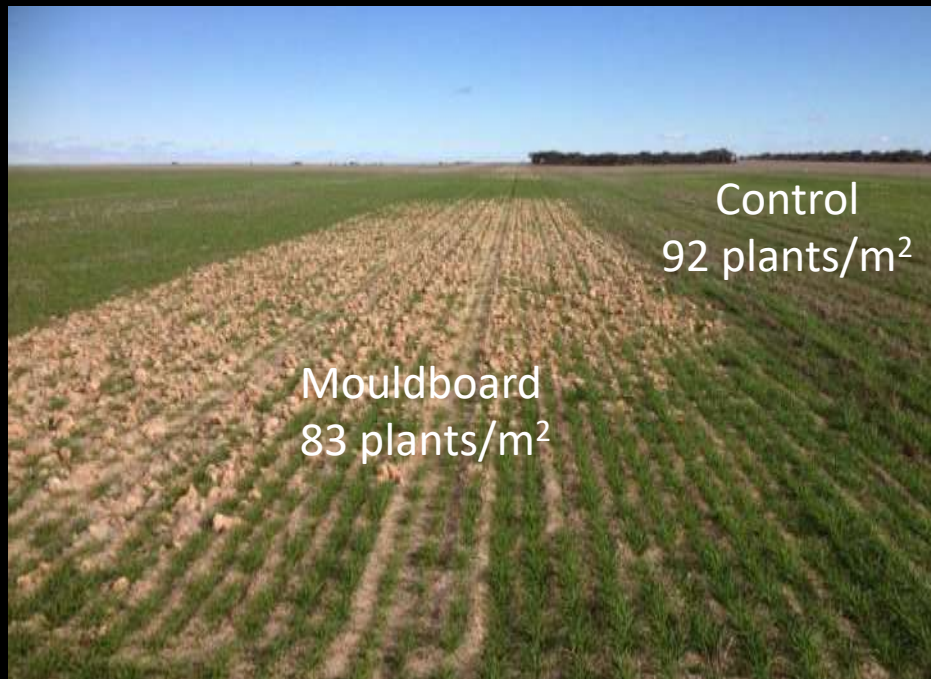
Clay the poor patches of sand

Improve seeding system- alpha disc 7.5inchs rows that scalp the repellent soil away into the ridges



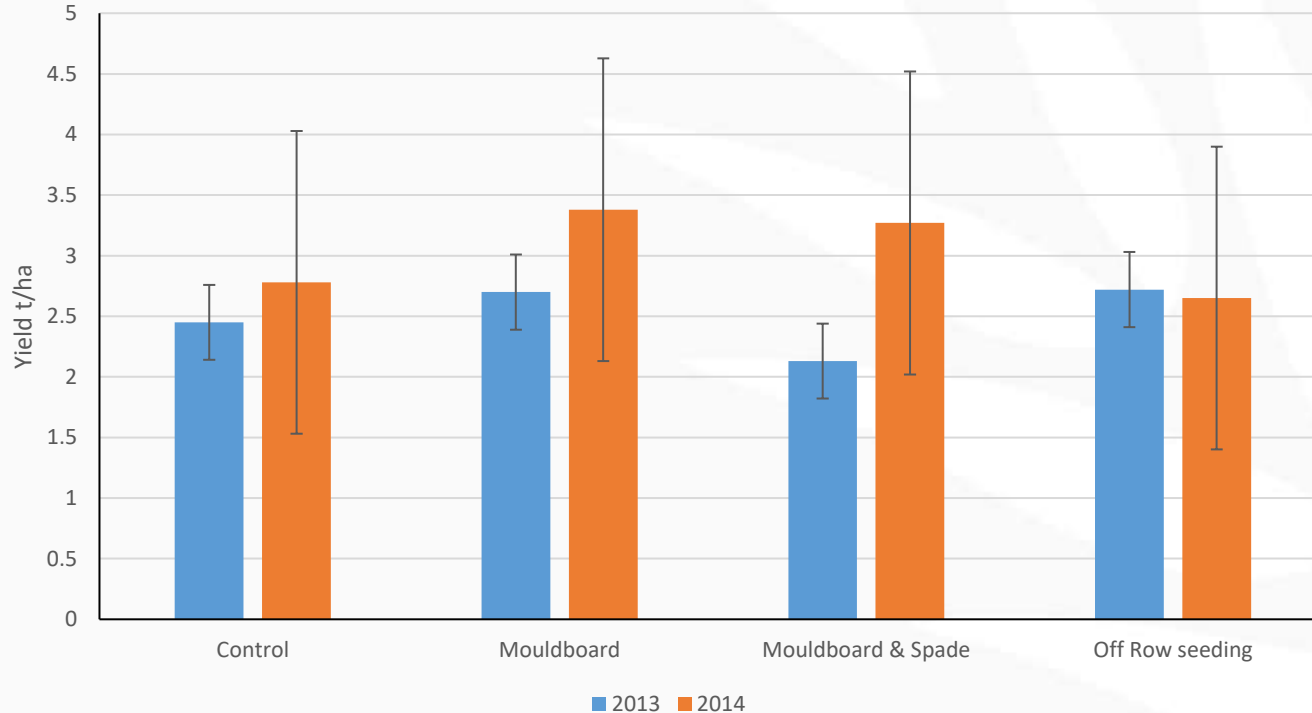
Mouldboard ploughing duplex soils can leave the surface cloddy in patches

Cloddy surface leads to poor plant establishment



(Bakker 2013)

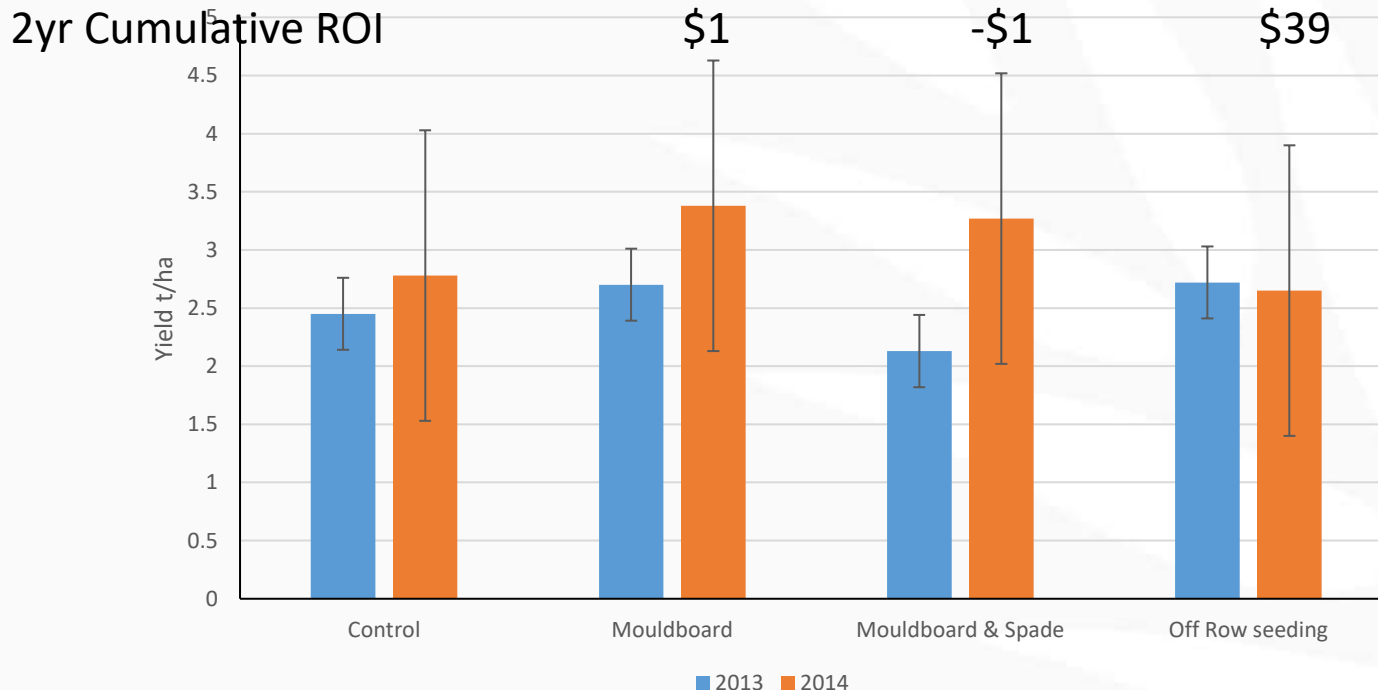
Water repellent soil amelioration trial Ravensthorpe



LSD (5%) = NS

(Bakker 2013)

Water repellent soil amelioration trial Ravensthorpe



* Grain price \$280/t, Mouldboard = \$120/ha Mouldboard and spade = \$270/ha



Still clumps after 7 years

Rolled every year since 2014

“Speed till” in 2017

Now lumps are smaller than fist

Still having negative effect on crop in patches



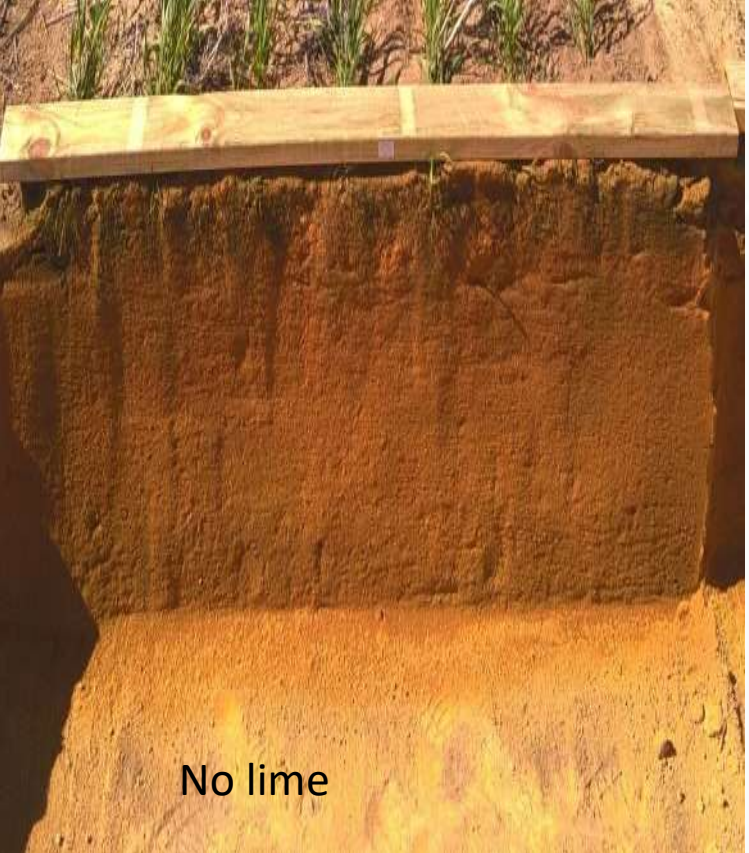
Solution

- × Zoning for depth to clay with EM and Gamma - variability is too high for sampling resolution
- ✓ Target poor sandy patches for claying (min 100 t/ha)
- ✓ On-row seeding (alternate years)
 - i-Till used to seed inter-row
 - Better distribution of nutrients
 - Disc opener system to place seed under row

Soil pH profile with shallow incorporation



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No lime



Lime

- 0
- 10
- 20
- 30
- 40
- 50
- 60

Re-engineering the soil pH profile



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Incorporate lime at different depths while maintaining natural soil horizons



- Excavated and incorporated to 45 cm
- Five treatments
- Randomised
- Replicated
- 3x2 m plots

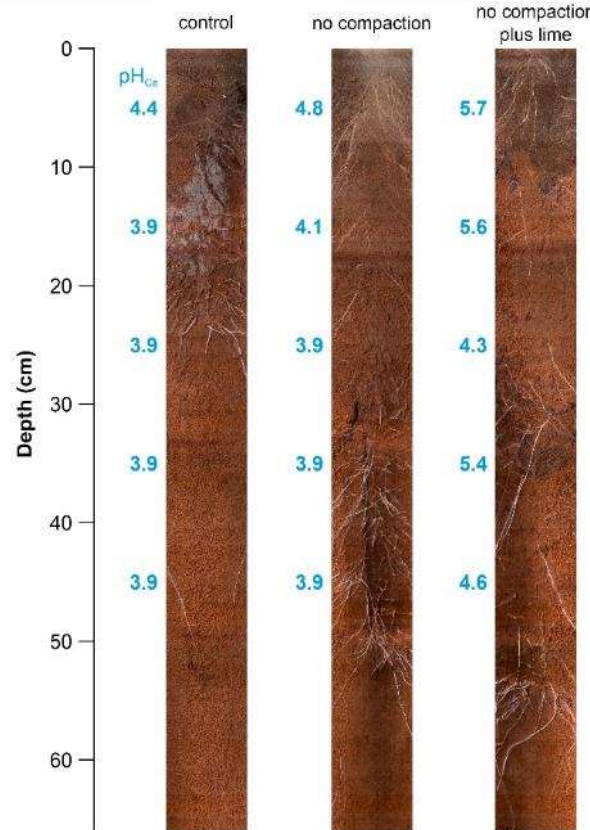
Root growth when pH profile re-engineered



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360 degree camera



- Control = ~20 cm
- Incorporation only = ~60 cm
- Deep lime incorporation = ~65 cm + fine roots

When ploughing and ripping acid sands deeper to mix lime you can find rocks

Big rocks!!!



SOURCE: TONY MURFIT

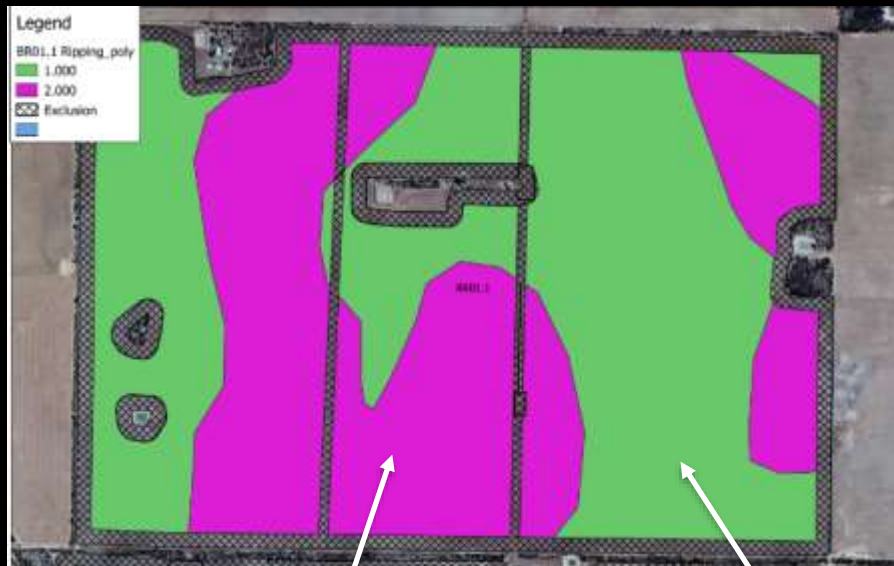
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OOPS!!!

Solution- amelioration zone maps

Deep ripping



ROCK WARNING ZONE

Be ready to lift the ripper

RIP ZONE

One way ploughing



SOURCE: TONY MURFIT, WARAKIRRI CROPPING

After amelioration the soil is soft....



.....very soft especially when wet!





SOLUTIONS

Use a roller when deep ripping

Seeder with independent depth control

Match your wheel tracks

Leave tracks unripped

Or sometimes shallow ripping the tracks can help

Renovate your wheel tracks if rutted

Cross ripping???

CONCLUSION

Know your soil properties to depth in 10cm increments and across the paddock

Ameliorate to conditions not the calendar

If in doubt leave it out

Keep in mind doubling the load reduces the life of the bearing by 10 times -check engine oil for signs of wear

ACKNOWLEDGEMENTS



- DPIRD and GRDC projects *DAW1902_003RTX*, *DAW190_006RTX*, *DAW00252*
- Jenni Clausen, John Bruce, Chad Reynolds, David Hall, Tom Edwards DPIRD
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