

SALINE LAND PROJECT UPDATE FEB 2023

**What I think I know,
and don't know,
but hope to find out,
after Year 1 of the project.**



Chris McDonough



DRY SALINE LAND DYNAMICS.

How does it work?



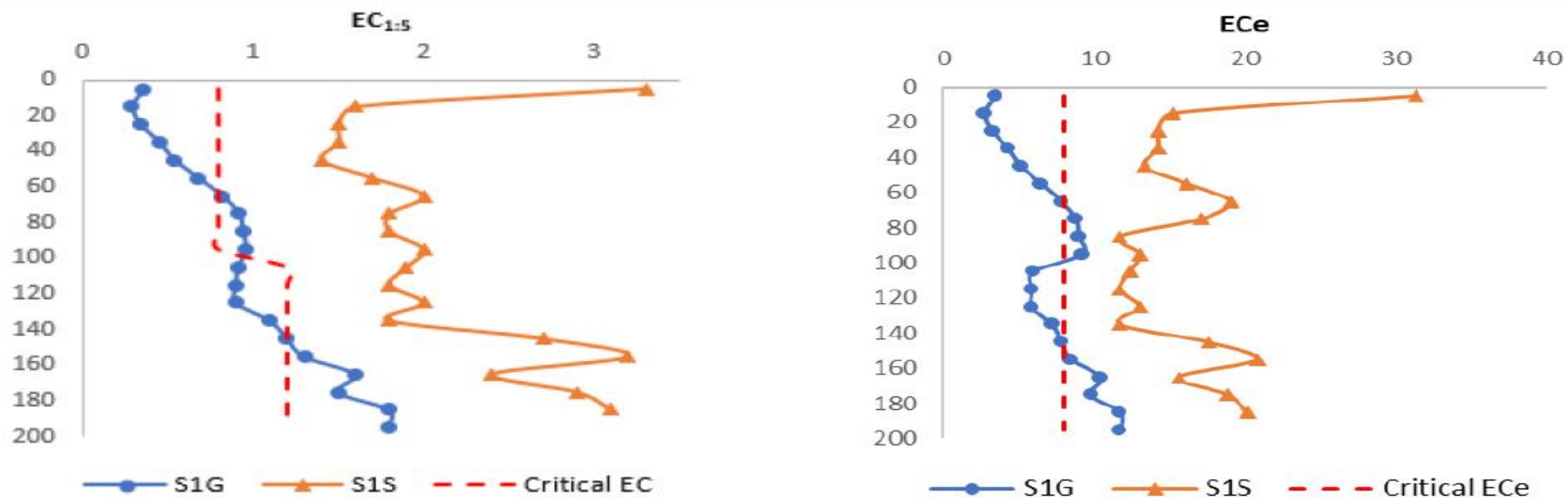
SCHMIDT - WAIKERIE



Image 2: Surface comparison (Schmidt). Good, S1G (left), salt-affected, S1S (right).



Comparison of EC_{1:5} and EC_e down the soil profile: Schmidt



Unaffected ground

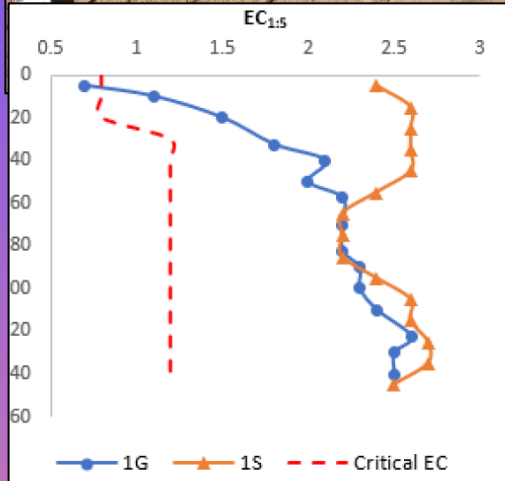


Transient Salinity
from
Subsoil Layers
makes its way to the
surface through
Evaporation & Capillary Rise
to concentrate in the
Surface Layers
making them
Temporarily or
Permanently Toxic
to crop and pasture
growth.

Affected bare patch



Unaffected ground



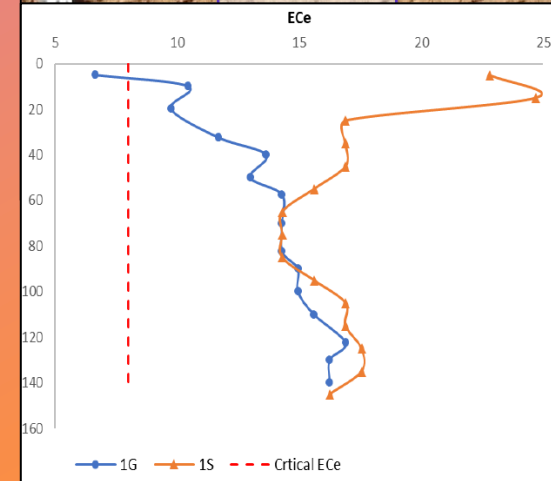
Dry Saline Land Impacts are greater due to:

1. Higher subsoil salinity levels not always
2. The soils strong wicking tendency
3. Long hot dry periods - drought/summer (increased evaporation & wicking)
4. Lack of soil cover – bare over summer

But in some areas are quickly reversed after high rainfall due to:

1. Temporary leaching of salts from surface layers
2. Dilution of salts toxic affects on crops germination & establishment

Affected bare patch



Key management objectives

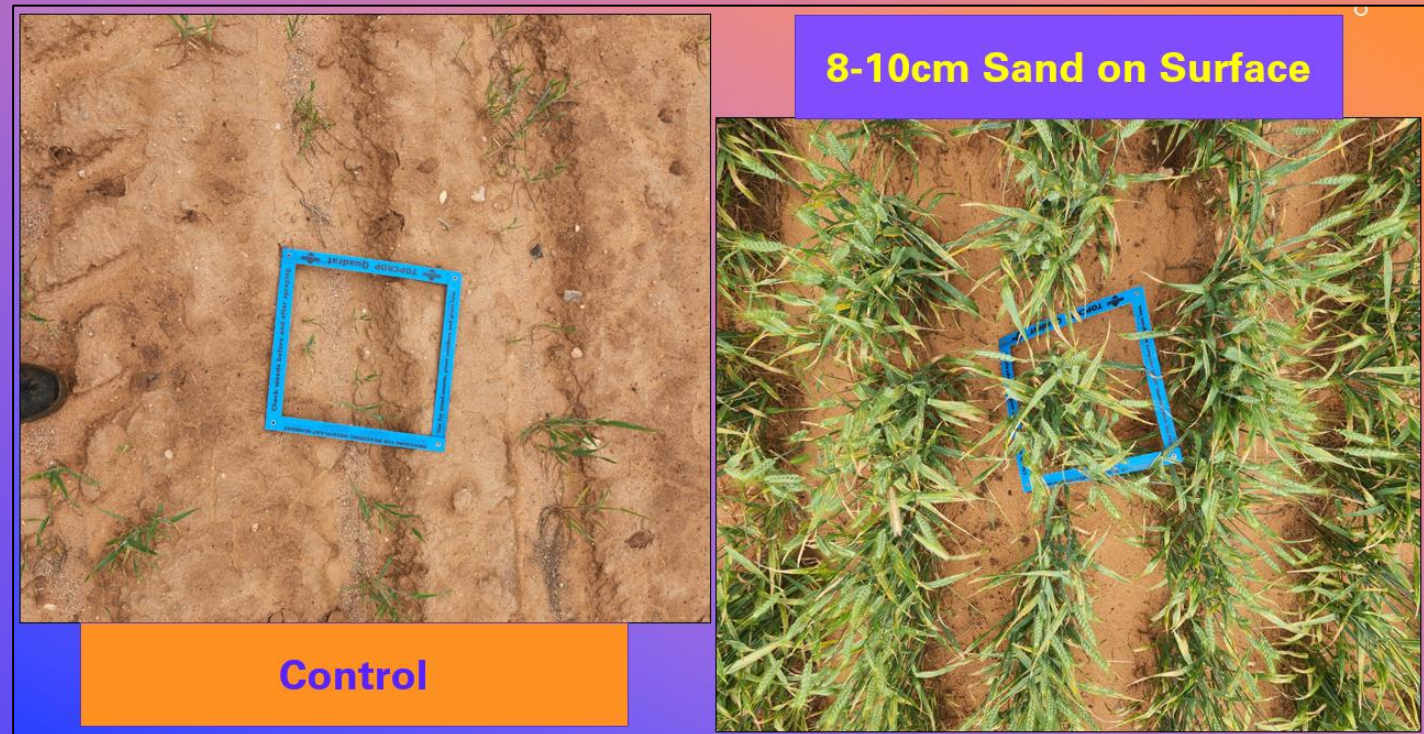
- **Change the Soil / Reduce Surface Salinity** – to allow plants to grow
- **Establish soil cover – maintain cover – never allow it to bare out**
– provide more protection against evaporation and capillary rise
- **Ameliorate the subsoil layers (top 30cm) to reduce the wicking as well as decrease subsoil saline toxicities.**
- **Find practical and profitable, salt tolerant agronomic options**



What I know works...

Adding Sand on Surface

- Evidence that 8-10cm sand after 4 years added sand yielded 2t/ha vs 0t/ha where not applied at Waikerie.
- Original soil (now 10cm depth) restored back to health.
- 5 other sites showed approx. 1.5-2.5t/ha yield advantage in 2022.



Adding Sand on Surface



4 year previous
Sand on Surface

Adding Sand on Surface

**4 year previous
Sand on Surface**

Untreated



Adding Sand on Surface

How much sand is enough?

- to germinate seed,
- to limit capillary rise with salt,
 - is economically viable,
 - is physically practical,
- will provide lasting results?

I currently think 8cm sand.

*Ave 1.5t/ha/yr benefit over 5 years =
approx. \$1775/ha extra income
(@\$350/t and \$170/ha crop input costs).*

*If sand is close, farmer has land plane,
labour available...*

*larger areas may be viable to fix – not
just small patches*

*Am interested in other project site
results on much lower rates...*



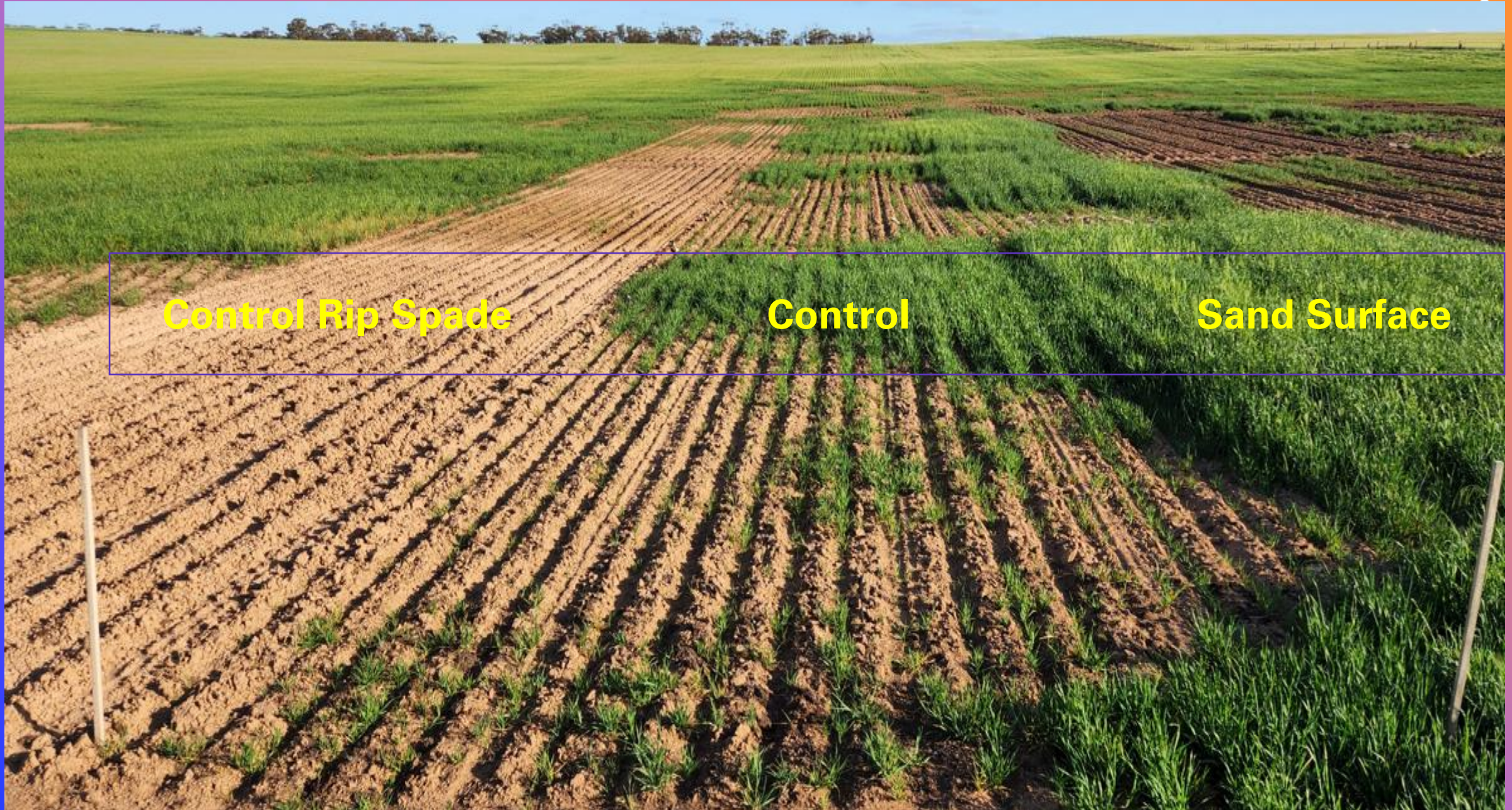
Sand 2.4t/ha

Control 0.1t/ha

9/3/202

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Heavy soil site, Mannum



Control Rip Spade

Control

Sand Surface

Current advice on using sand...



- Where smaller or early developing patches
- Of land permanently scalded (not quickly recovering after rain)
- Adding 8cm sand on surface will permanently fix!!
- On larger areas or many patches across paddock, practical viability decreases, and will depend on:
 - Severity of site
 - Proximity of available sand
 - Access to and costs of equipment, labour and time.



Just Add Water

Evidence that big rains make big difference... (50mm Nov prior)
But not as good as adding sand.





Sand 2.4t/ha

Nov Flood 1.4t/ha

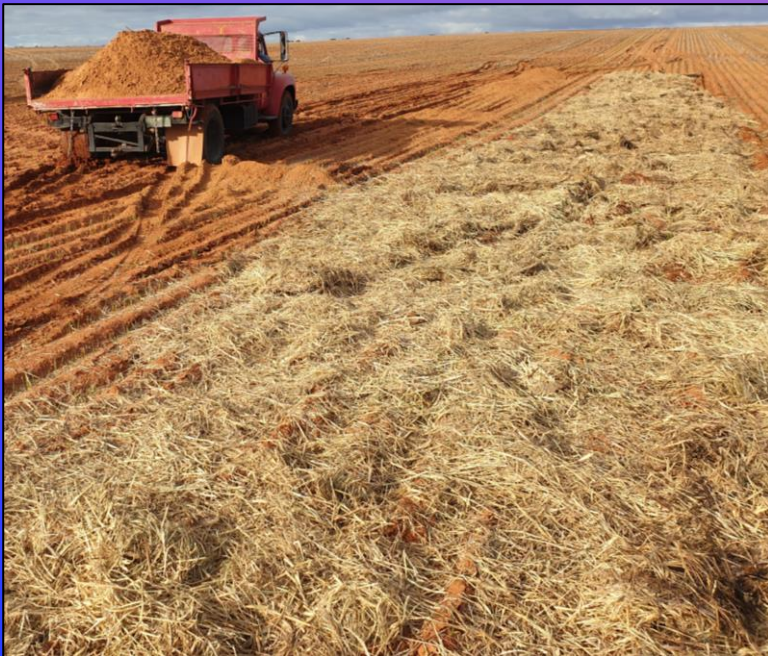
Adding manure on surface

- Clear benefits at some sites
- Less initial benefit on heavy sites with little rain early, but improved over season.
- Most sites was initially too thick and rich, but this year will be the real test.
- Manure mixed with sands also very promising potential.



Adding straw on the surface

- Clear benefits at some sites.
- Next soil test results will show impacts of straw in minimising wicking of salts to surface after summer.
- Improved soil organic matter and soil health
- Good option for smaller scald patches – labour, time, availability.



Ameliorating 0-30cm depth of soil.

- **Deep Ripping in Sand and/or manures**
 - One excellent result on heavy soil with early rains





Manure Surface

Manure Rip/Spade

Control



Sand Surface

Sand Rip Spade

**Sand Manure
Rip Spade**



Control Rip Spade

Control

Sand Surface

Ameliorating 0-30cm depth of soil.



- Ripping/spading – very poor result on heavy soil with dry start
 - Initial issues with mixing sodic clays into surface layers
 - Increased sand & OM to 30cm may be beneficial, will test this impact in 2023
 - Cannot recommend yet, or strategy of targeting soil wicking ability.



• Manure Sand Rip Spade

Manure Sand

Manure Surface



Sand Surface

Sand Rip Spade

**Sand Manure
Rip Spade**



Control Rip Spade

Control

Sand Surface



Ameliorating 0-30cm depth of soil.

- **Positive inclusion plates deep ripping and with organic matter**
 - Initially unsuccessful on heavy soil with dry start.
 - Some evidence of increased OM at depth that should be positive
 - Site had good and poor strips – possible compaction issues
 - 2023 analysis critical – cant recommend at this stage.



Ameliorating 0-30cm depth of soil.

- Reefinating in sand and / or manure on shallow stone
 - Slight improvements over surface application



2023 matching soil tests should be very informative for all soil amelioration sites.

Growing salt tolerant grasses to cover scalds. + ○

- Untested in very low rainfall in absence of parched water table.
- Puccinellia is establishing at some sites – wet spring helped!
- On seep sites soil recovers after 1 year of puccinellia cover.
- Has potential for severe sites but still assessing.



Growing summer crop cover.

- Issue of salt tolerance for crop establishment
- I have sown 2 sites with sorghum last November...
- Has worked for early stage mallee seeps.
- No recommendations as yet.



ALFORD TRIAL – SAM TRENGOVE

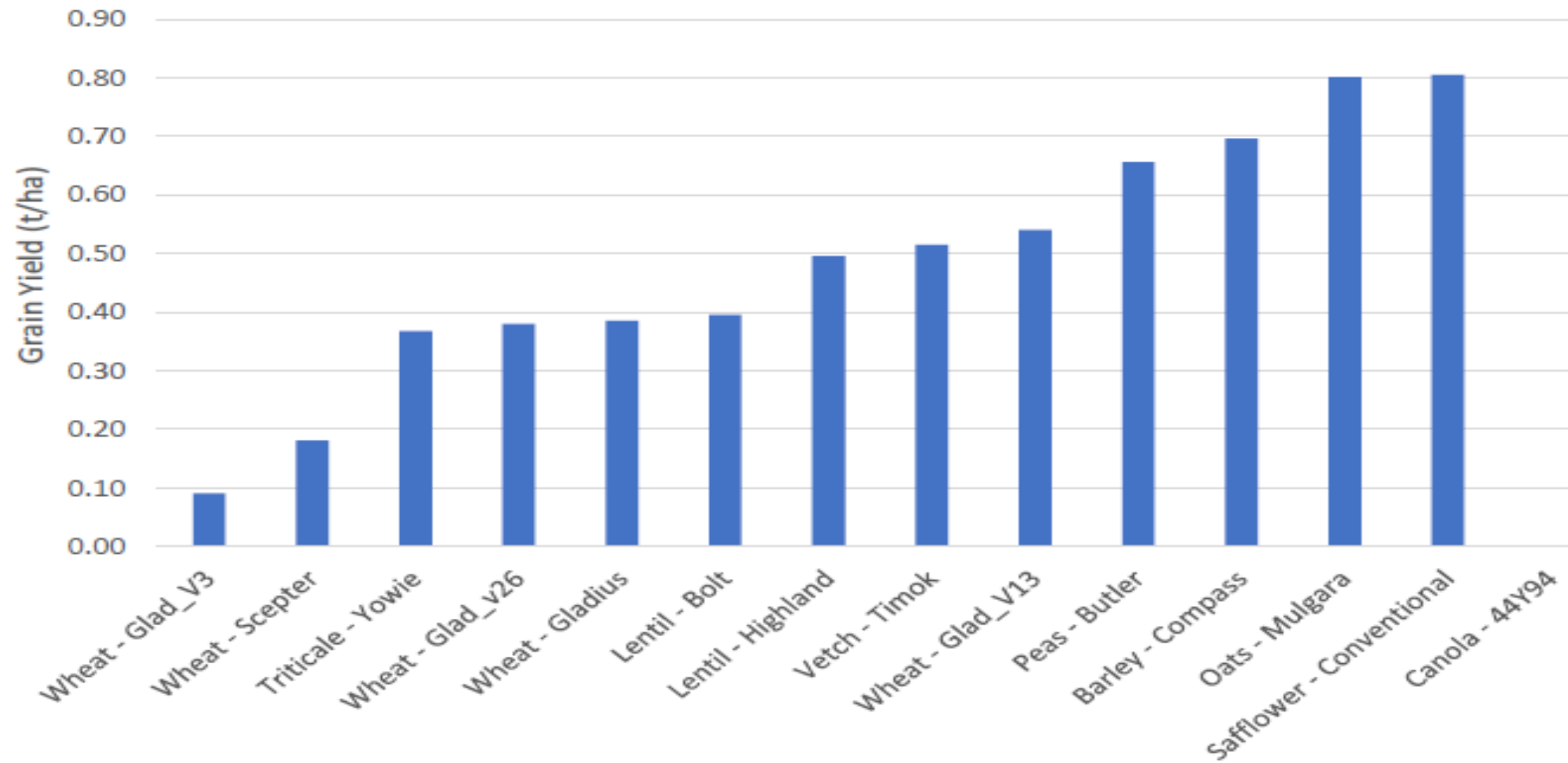


9/3/20XX

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Crop type results



Soil amelioration results

Treatment	Plant cover at harvest 2022 (%)	Grain yield (t/ha)
Control	18 a	0.12 b
Gypsum at 10 t/ha	30 a	0.19 b
Sand at 130 t/ha	45 ab	0.34 ab
Sand at 650 t/ha	70 bc	0.45 a
Sand at 1300 t/ha	90 c	0.57 a
Straw at 3.3 t/ha	45 ab	0.35 ab
Straw at 6.6 t/ha	40 a	0.52 a
Straw at 10 t/ha	38 a	0.46 a
Pr(>F)	<0.001	0.01
LSD (0.05)	27.8	0.24

Closing thoughts...

- Have 16 new sites to establish – about 6 secured, others on way
- Keen to cross sow existing sites with mulgara oats...
- Am trialling new silicon based fertiliser that may improve plant growth in saline soils...
- Will Soil Test in March – same plot site comparisons
- I have mainly been concentrating on bare patch sites, but there is also the huge impacts of poorly growing sites

Potential Decision Tree

For Dry Saline Land (*magnesia ground*)...

2 main aims for all Dry Saline Land Management:

- a. Stop salt accumulating in surface layers**
- b. Establish and maintain cover over scalded bare areas...**

Possible assessment questions:

- 1. Is it Dry Saline Land? – or RGW, CLS or a MS**
- 2. Assess Landscape – What is the general soil type? – Clay, loam, stone...**
- 3. How large is the affected area? – A specific patch or across wide area – too large for intensive soil amelioration (ie. sand placement, manure, mechanical etc...)**
- 4. How easily does it improve after high rainfall?. – Always bare/patching gets smaller/full crop production returns... (soil salinity ranges??)**
- 5. Do you have livestock grazing this paddock?**
- 6. Readily available resources? Sand, Straw, Manure, Machinery, Water, etc...**
- 7. Work out what to do. – work through the suitable management options – short site videos**

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***for the MSF "Building Resilience to Drought with
Landscape Scale Remediation of Saline Land"
project***



This project is supported by the Murraylands and Riverland Landscape Board through funding from the Australian Government's National Landcare Program and the landscape levies.

