FINAL PROJECT REPORT – MAY 2022
SOIL EROSION DEMONSTRATIONS

1. BACKGROUND

Wind erosion has been acknowledged by researchers and farmers to be a significant factor contributing to land degradation. In the past few years, severe wind events have been more common due to the changing climate throughout Western Australia. Whilst most research is seen to have been conducted in the more southern areas of Western Australia (www.agric.wa.gov.au/wind-erosion/managing-wind-erosion-southern-western-australia), the impact throughout the Wheatbelt is increasing. As such, it is important to demonstrate these mitigation practices for the local region to address.

Throughout 2021/2022 Liebe Group developed a series of grower-scale demonstrations that focused on various erosion management practices. This was expected to include management practices such as extended ground cover (i.e. stubble/vegetation/pasture/crop options), tree windbreaks/shelter belts, seeding/amelioration timing and techniques.

The Liebe Group also planned an extension opportunity to assist in educating farmers on identifying erosion prone soils types and paddocks, as well as potential management strategies.

2. EXTENSION ACTIVITIES

A presentation was conducted at the Liebe Group's Crop Updates on the 2nd March 2022 (see attachment 1). There were 75 people in attendance including local grain growers, industry and researchers. Justin Laycock, a research scientist from the Department of Primary Industries and Regional Development, presented on the topic. Key messages were provided during this presentation included:

- Paddocks should have at least 50% groundcover to reduce the risk of wind erosion. This is 600 kg/ha of pasture or 1 t/ha of cereal stubble.
- DPIRD are using groundcover imagery derived from the Landsat satellite as an indicator of erosion risk throughout the grain belt. The primary aim is to protect the soil resource for future generations.
- About 20% of the landscape around Dalwallinu was susceptible to wind erosion in summer 2020–21.
- The West Midlands region had 15% of arable land with less than 30% groundcover so there was potential for widespread and severe erosion.

Copies of Justin's technical report (see attachment 2) were provided to attendees for further information. Additionally a demonstration report (see attachment 3) on site 3 was included in the Liebe Group 2021/22 R&D Results book, which is distributed to all Liebe Group members. Site 2 was viewed and discussed by 14 local growers and industry on the 03/09/21 during one of the Liebe Group's local trial site tours, the "Gen Y Bus Tour". Discussion was animated, and interest in the effect of stubble height on crop performance and soil management was avidly discussed.

3. RESULTS FROM DEMONSTRATIONS

SITE 1: Minimum till disc seeder demonstration, to maintain stubble load and minimise soil disturbance to decrease wind erosion risk

Host Producer: Boyd Carter, KL Carter & Co
Location: Jibberding, West Australia

Demo Details

This demonstration site came from the farmer having an interest in developing a higher residue cropping system that could improve moisture retention and ground cover. This site was planted to wheat in 2020, which was then harvested at 3 different heights and canola sown in the following year, in between the rows. These treatments could then be assessed for plant and weed growth and erosion risk.

Table 1: Treatments at Site 1, Jibberding.

Code	Name	Description	Area (ha)
T1	Low Stubble	Lower than average stubble load (<10cm) sown over with a minimum till disc seeder.	1
T2	Standard Stubble	Standard height stubble (≈10cm) sown over with a minimum till disc seeder.	285
T3	High Stubble	Higher than average stubble load (>10cm) sown over with a minimum till disc seeder.	1

Table 2: Site Composition pre project.

Depth (cm)	pH ($CaCl_2$)	Col P (mg/kg)	Col K (mg/kg)	S (mg/kg)	N(NO_3) (mg/kg)	N(Nh_4) (mg/kg)	EC (ds/m)	OC (%)	Cover (kg/ha)
0-10	5.7	14	101	1.2	6	2	0.028	0.87	(<10) 40
10-30	5	9	37	13.5	5	1	0.036	0.71	(~10) 60
30-50	4.3	2	16	13.7	3	2	0.028	0.5	(>10)
50-100	4.2	1	19	38.7	3	2	0.045	0.19	110

Results

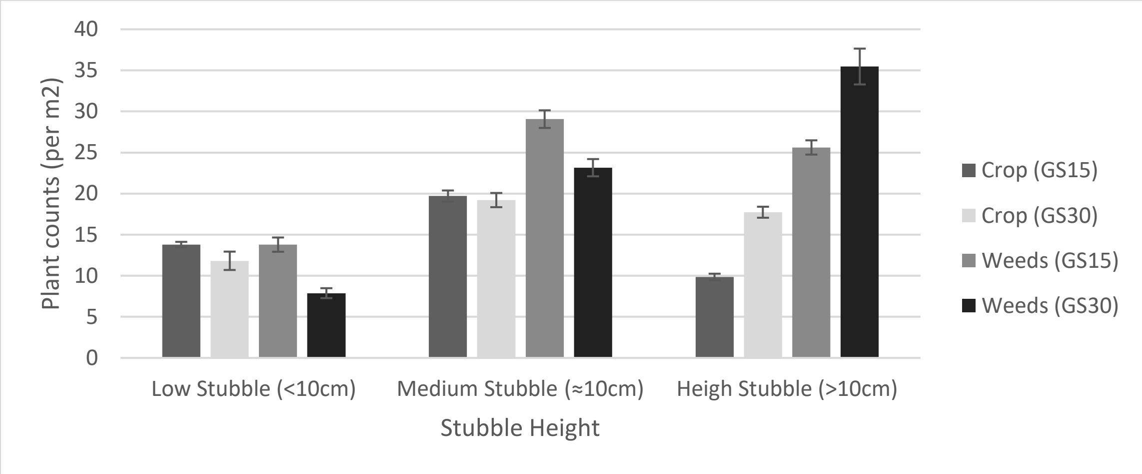


Figure 1: Crop and Weed count per m2 during Growth Stage 15 and Growth Stage 30 at different stubbles heights, Jibberding.

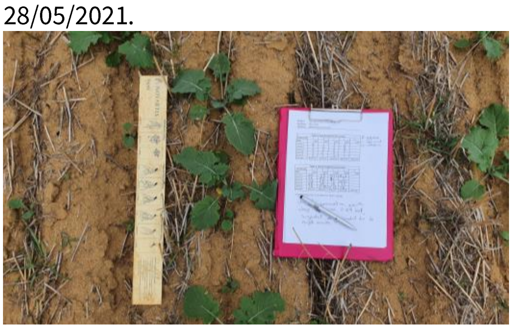
Figure 1 indicates that stubble loads may lead to a decrease in the efficacy of weed control. Instances of this have previously been observed, where the higher stubble load decreases herbicide soil contact and makes the product less effective. However this may be off-set by improvements in soil stability, moisture retention and soil organic carbon levels. If a high residue system was to be continued on this site, it is safe to assume the risk of wind erosion would be significantly less than in a low stubble system.

A system that utilises high cut stubble does have challenges, however in a drying and variable climate, there are clear advantages for both crop production and soil stability and many of these challenges can be overcome with good planning and a continued focus on Research and development of this system.

Figure 2: The Jibberding Site being discussed during the Gen Y bus tour.

Figure 3: Low stubble load (left), in comparison to high stubble load (right).

Figure 4: Plant counts being collected at the site on 28/05/2021.



SITE 2: Ameliorating erosion-prone soil through the application of clay and straw

Host Producer: Shaun Fitzsimons, Fitzsimons & Co
Location: Buntine, Western Australia

Demo Details
The landholder identified this site as being at risk to wind erosion, as the site was underperforming due to soil constraints being present. They saw an opportunity to increase the water holding capacity, productivity and ground cover if the soil constraints could be ameliorated and if soil organic carbon levels were increased through addition of soil amendments.

Table 3: Outline of proposed treatments at Site 2, Buntine.

Code	Name	Description	Area (ha)
T1	5t per ha	Deep ripped to 450mm, spread with 5t/ha clay soil and 2t/ha straw then disc ploughed to incorporate.	16
T2	10t per ha	Deep ripped to 450mm, spread with 10t/ha clay soil and 2t/ha straw then disc ploughed to incorporate.	16
T3	15t per ha	Deep ripped to 450mm, spread with 15t/ha clay soil and 2t/ha straw then disc ploughed to incorporate.	16
T4	20t per ha	Deep ripped to 450mm, spread with 20t/ha clay soil and 2t/ha straw then disc ploughed to incorporate.	16

Table 4: Site Composition pre project.

Depth (cm)	pH ($CaCl_2$)	Col P (mg/kg)	Col K (mg/kg)	S (mg/kg)	N(NO_3) (mg/kg)	N(Nh_4) (mg/kg)	EC (ds/m)	OC (%)	Cover (kg/ha)
0-10	5.4	13	24	41	1	1	0.054	0.23	15
10-20	4.1	4	17	66	1	1	0.066	0.24	
20-30	4.0	1	16	83	2	1	0.064	0.18	
30-40	4.0	1	16	77	8	0	0.065	0.16	
40-50	4.0	2	15	73	16	1	0.068	0.14	

Comments:
Implementation was complicated by high levels of rainfall causing water logging that limited site access. The host was not able to access the site to spread the clay and straw prior to seeding, so although the ripping did occur, no clay or hay was added. The demonstration would need to be completed in a following year, as results from 2021-2022 season would not produce target data. The ripping alone is unlikely to decrease soil erosion, as the clay and straw is needed to improve soil structure and make it less vulnerable to wind erosion risk over the longer term.

However, where soil compaction is limiting crop growth, deep ripping can alleviate this and lead to improvements in crop growth and subsequent paddock cover. Clay and straw will be spread next year to ameliorate the poor soil structure. We intend to continue monitoring and extend results the following year regardless, as strong interest in the amelioration has been evident.

SITE 3: Sown pasture shrubs in an erosion-prone area to establish year-round multi-story ground cover.

Host Producer: Chris Kirby, CL & ML Kirby
Location: Beacon, Western Australia

Demo Details
The paddock host has observed that a low lying area with poor infiltration is highly prone to erosion events when significant rainfall events occur. To address this he has both installed a deep drainage ditch, and planted shrubs on either side, taking the area out of his cropping rotation. He is hopeful the treatment will be effective in developing a multi-story pasture and providing year round ground cover in the area to minimise erosion risk.

Table 5: Outline of treatments at Site 3, Buntine.

Code	Name	Description	Area (ha)
T1	Sown Saltbush	Sown pasture of Atriplex nummularia, Anameka Forage Shrub & Eucalyptus plenissima kochii	68
T2	Self-Sown	Control, Un-ameliorated pasture left to self-sow	3

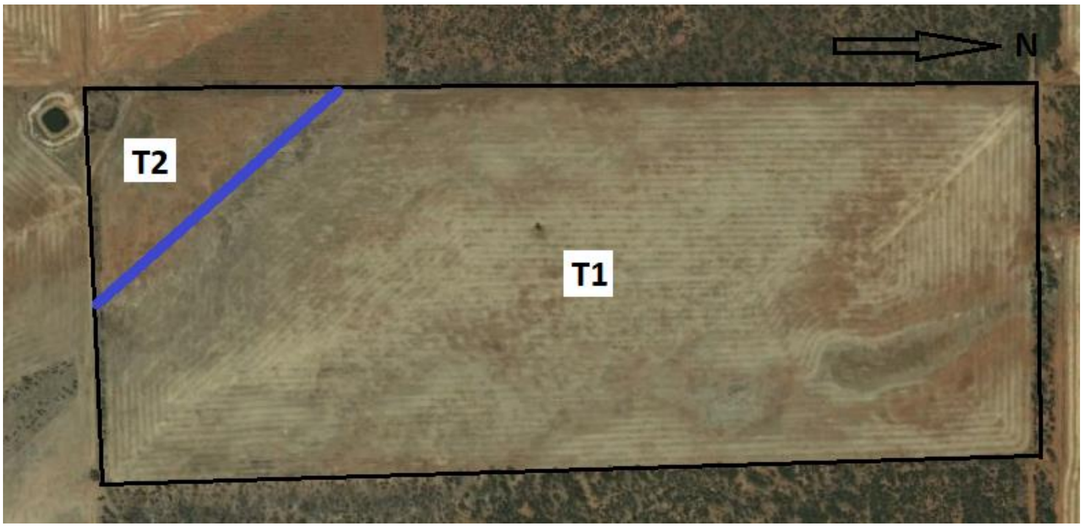


Figure 5: Site Layout and Treatment Location for Site 3, Beacon.

Results

Table 6: Site Composition pre project.

Depth (cm)	pH ($CaCl_2$)	Col P (mg/kg)	Col K (mg/kg)	S (mg/ kg)	N(NO_3) (mg/kg)	N(Nh_4) (mg/kg)	EC (ds/m)	OC (%)	Cover (kg/ha)
0-10	6.3	18	212	127	2	5	0.939	0.47	90
10-20	5.9	6	140	108	3	4	0.609	0.25	
20-30	6.0	4	141	49	3	3	0.659	0.16	
30-40	6.0	4	245	79	4	2	0.844	0.16	
40-50	6.5	4	254	116	4	2	1.323	0.15	

Seeding: Sowing would have ideally taken place earlier in the season but due to an above average rainfall event experienced (ex-tropical cyclone Seroja in April 2021) site activities were delayed. The site was seeded in September 2021 with 68 ha sown to the pasture mix as per the site plan. Establishment was successful and monitoring activities undertaken throughout the summer.

Figure 6: Saltbush being sown at the Kirby site, Beacon, September 2021

As seen in the biomass imagery snapshots in Figures 7 and 8, the site activities are visible. Tram lines indicate where the treatments were seeded. No significant results can be seen from these figures due to the short timeframe since establishment. It is expected to see further biomass increase over the coming years as the shrubs further establish.

Figure 7: NDVI Imagery - Early 2021

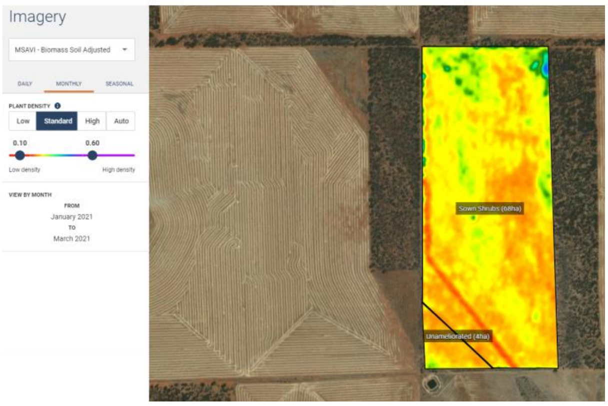


Figure 8: NDVI Imagery - Early 2022

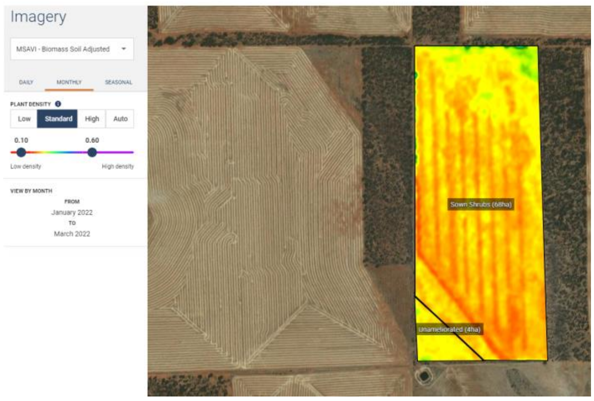


Photo comparison showing plant growth over 3.5 months.

Peg 11: Taken December 2021 	**Peg 11: Taken April 2022** 
Peg 16: Taken December 2021 	**Peg 16: Taken April 2022** 
Whole Site: December 2021 	**Whole Site: April 2022** 

Wind Erosion Measurements

Erosion measurements were taken over the summer period utilising a 'peg' approach. 16 pegs were installed throughout the paddock with the height of the soil marked. After 3.5 months in the ground, they were removed with any soil change noted. Due to the short period in the ground (project timing limitations) and above average rainfall there was no evident erosion of the soil at this time.

Significant change in practice occurred over the past 12 months for this land, including the sowing of 68ha of pasture shrubs to reduce the risk of wind erosion. The paddock was successfully implemented with results expected to increase in the coming years.

4. PROJECT SUMMARY AND CONCLUSION

About 20% of the landscape around Dalwallinu was susceptible to wind erosion in summer 2020–21. Growers in the region are actively looking to improve their farming systems so as to reduce the susceptibility of the land to erosion events. The three demonstrations presented through this project are good examples of how farmers can implement changes that improve both production and environmental outcomes.

Leaving more residue from previous crops in paddocks and establishing subsequent crops (ie canola) in between this residue is a significant change from lower cut residue or full paddock burning. Whilst there are challenges to making this system work, more farmers are exploring this concept and overcoming the machinery challenges to make the system work.

Ameliorating and building soil organic matter on poor sands is another concept that can assist in reducing a paddocks risk of wind erosion. By removing constraints such as soil compaction, non-wetting, poor organic carbon levels and low pH, this can lead to improved crop growth and in turn increased residue biomass and soil organic carbons.

Finally, utilising perennial pastures in a mixed farming system on poor performing soils has numerous soil health benefits including soil stabilisation, improved water use efficiency and increased carbon storages on that land. In turn this system can also be used to maintain sheep production during the autumn feed gap, reducing pressures on paddock residue that would be otherwise be used for sheep feed.

It is likely that with continued development of these systems in the region, there would be a significant reduction in erosion risk, increased soil health and improved productivity.