

# Improved productivity on sandy soils – Kybunga case study

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## Key Findings

- All soil disturbance treatments behaved the same in the absence of chicken litter, increasing grain yield by 1.02 t/ha (24%) over the control.
- Chicken litter applied at 7.5 t/ha with ripping or spading increased grain yield by a further 0.66 t/ha compared to ripping or spading alone.
- Chicken litter application increased grain protein by 1.0 and 1.7% with ripping and spading, respectively.

## How was it done?

<b>Trial location</b>	Kybunga (Blyth BOM annual rainfall 239 mm, growing season 208 mm)		
<b>Plot size</b>	1.90 m x 15.0 m		
<b>Seeding date</b>	May 15, 2019	<b>Fertiliser</b>	32:10 @ 100 kg/ha IBS, Urea @ 100kg/ha
<b>Variety</b>	Scepter		SOA @ 150 kg/ha (no chicken litter plots only)
<b>Soil constraints</b>	Low organic carbon, low cation exchange capacity, mild water repellence and compaction (anecdotal, not yet measured)		

The trial was a randomised complete block design with seven treatments and four replicates (refer to list below). The trial was located on a sand hill at Kybunga with two replicates across the top of the hill and two replicates on the western slope of the hill. Chicken litter was applied to the surface of plots prior to the implementation of soil disturbance treatments.

All soil disturbance treatments were implemented on May 13, 2019. Ripping treatments were conducted using a Williamson-Agri Ripper, a bent leg low disturbance ripping machine with four tynes per plot. Ripping depth was either shallow (30 cm) or deep (50 cm), Spading was conducted with a 1.8 m Farmax spading machine operated at 5 km/h to a depth of 30 cm.

Post emergent urea (July 25) was applied by the grower using commercial application equipment operated perpendicular to the plot lengths. Sulphate of ammonia (SOA) treatments were applied by hand on August 27.

### Treatments

- 1 District practice (Control)
- 2 Shallow ripping to 30 cm (Rip30)
- 3 Deep ripping to 50 cm (Rip50)
- 4 Spading to 30 cm (Spade30)
- 5 Deep ripping + Spading (Rip50 + Spade)
- 6 Deep ripping + Chicken litter @ 7.5 t/ha (Rip50 + Chick)
- 7 Spading + Chicken litter @ 7.5 t/ha (Spade + Chick)

Crop measurements during the growing season included an emergence score and early vigour on July 3 and Green Seeker NDVI July 24, August 22 and September 23. The trial was harvested for grain yield on November 17, 2019 and grain quality was assessed post-harvest.

## Results and Discussion

Green Seeker NDVI data recorded in late July showed ripping treatments, either shallow, deep or combined with spading improved early crop vigour. By late August there was no significant difference between any of the disturbance treatments. On average all disturbance treatments had NDVI values 26% higher compared to the control. There was still an increase in crop NDVI for these treatments by the September 23 scan, however this had reduced to 10%. The addition of chicken litter had a greater effect on the crop compared to disturbance treatments at the early NDVI assessment. For later assessments, chicken litter response was similar to the disturbance treatments.

Crop lower limit soil samples were taken from selected treatments to measure the difference between extracted moisture. No measurable difference was identified (data not shown).

Grain yield correlated with NDVI, indicating higher biomass resulted in higher grain yield (Figure 1) in this trial. The four disturbance treatments performed the same, producing an average 5.29 t/ha. This was a 1.02 t/ha (24%) increase compared to the control. The addition of chicken litter to either spading or deep ripping produced an additional 0.66 t/ha.

Grain protein did not vary between the control and the four disturbance treatments, averaging 10%. The addition of chicken litter to the deep ripping treatment increased protein to 10.7%, despite the significant increase in grain yield. The action of spading in the chicken litter appears to have increased the availability of nitrogen from the chicken litter, as this treatment had the highest protein, 11.6%. Test weight was lower in the chicken litter treatments (average 76.3 kg/hL) compared to the control treatments. However, this remained above the threshold for H1 quality classification (76 kg/hL). Grain screenings were not affected by any treatment (data not shown).

Partial gross margin (PGM) analysis shows in the first year after disturbance, large returns can be captured that cover the cost of treatment (Table 2). Return on investment (ROI) is greatest for ripping treatments, as it has a lower cost basis than spading. A positive return on chicken litter was observed in year one, however this would be cost neutral if not for the increase in grain protein and associated increase in pay grade. It has been demonstrated in several other trials that yield improvements are likely to continue beyond the first season, which is essential to justify the high costs for some treatments. This trial will be continued for another two seasons to monitor the longer-term treatment effects on productivity and profitability.

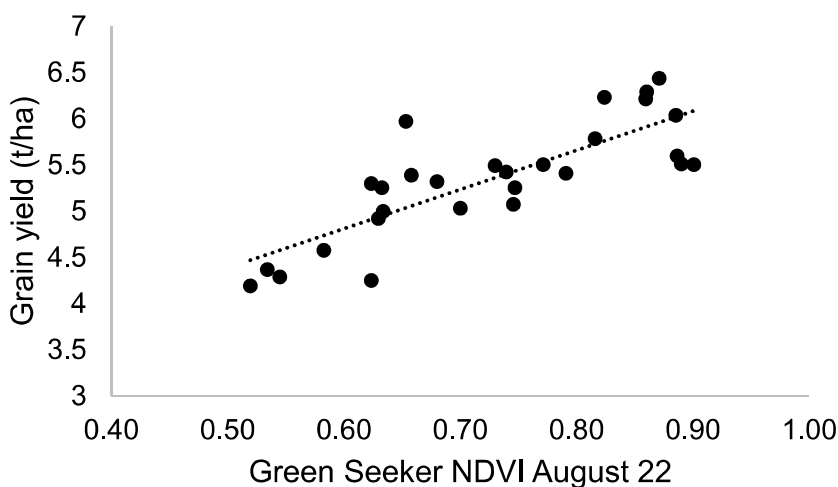


Figure 1. The relationship between Green Seeker NDVI recorded August 22 and grain yield (t/ha),  $y = 4.2389x + 2.2641$ ,  $R^2 = 0.6526$ .

Table 1. Green Seeker NDVI recorded July 24, August 22 and September 23, grain yield (t/ha) and protein (%) for the Kybunga sandy soil trial, 2019.

Treatment		NDVI July 24 2019	NDVI Aug 22 2019	NDVI Sept 23 2019	Grain yield (t/ha)	Protein (%)
1	Control	0.545	0.553	0.602	4.27	10.3
2	Rip30	0.598	0.675	0.641	5.07	10.1
3	Rip50	0.643	0.695	0.676	5.42	9.7
4	Spade30	0.562	0.700	0.659	5.23	9.9
5	Rip50 + Spade	0.613	0.713	0.666	5.46	10.0
6	Rip50 + Chick	0.770	0.865	0.729	6.02	10.7
7	Spade + Chick	0.791	0.880	0.734	5.93	11.6
<i>LSD (P≤0.05)</i>		<i>0.048</i>	<i>0.059</i>	<i>0.039</i>	<i>0.51</i>	<i>0.6</i>

Table 2. Partial Gross Margin analysis for the first year of the Kybunga trial. Price assumptions, disturbance as per table, chicken litter \$34.5/t incl spreading, SOA \$400/t, wheat ASW \$300/t, APW \$310/t, H2 \$320, cost of spading in Rip50 + Spade treatment reduced due to pre ripping.

Treatment	Disturbance (\$/ha)	Chicken litter (\$/ha)	SoA (\$/ha)	Total (\$/ha)	Grain yield (t/ha)	Income (\$/ha)	Partial Gross Margin (\$/ha)
Control			60	60	4.27	1282	1222
Rip30	50		60	110	5.07	1520	1410
Rip50	70		60	130	5.42	1626	1496
Spade30	200		60	260	5.23	1569	1309
Rip50 + Spade	250		60	310	5.46	1637	1327
Rip50 + Chick	70	260		330	6.02	1866	1536
Spade + Chick	200	260		460	5.93	1899	1439

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