

Long Term Soil Biology Trial

Aim: To investigate the potential of biological and organic matter inputs to increase soil water storage, target long-term yield increases and soil improvement.

Research Officer: Marcus Hemsted

Company: Liebe Group

Farmer: Stuart McAlpine's Property

Location: Liebe Group Long Term Research Site (LTRS)



Background: As part of a GRDC Soil Health Project, this long term trial has been set up to address management of soil constraints limiting yield. The site was chosen as it had no significant chemical or physical constraints, and was intended to demonstrate the capacity for increasing grain production. 2004 was the first year of the trial and treatments were designed to enhance moisture conservation and stimulate soil biota, whilst demonstrating the potential effect of treatments on grain production.

Trial Details:

Plot size and replication	10.5m x 80m, 3 replicates. Randomised block design.
Soil type	Deep yellow sand
Sowing date	28 th – 30 th May 2004
Conditions at sowing	Drying – moist at 30 mm
Machinery	Dept of Agriculture Research Bar – knife points
Seeding rate	Wyalkatchem – 80 kg/ha
Fertiliser	Summit MAPZSC – 60 kg/ha. Top dress - MOP – 40 kg/ha & MAPZSC - 40 kg/ha, 60 L/ha UAN
Herbicides and Insecticides	0.7 L/ha Roundup Powermax, Spray seed – 1 L/ha, Paragon – 250 mLs/ha, LVEMCPA 100mLs, Turret – 1 L/ha
Paddock History	2003 = Belara lupins, 2002 = wheat, 2001 = canola
Rainfall – Growing season	275mm

Trial Design:

The trial consists of 3 banks of 19 randomised plots; the site was deep ripped to 12” on 450mm spacing immediately prior to sowing following the identification of a physical hard-pan at 20 cm depth. This ensured there was no physical constraint to yield present. Sowing was by a 10.5m knifepoint bar and permanent tramlines have been established on the trial.

Treatment	Rate	Method
Organic matter (barley hay)	20 t/ha	By Hand
Zeolite	1 t/ha	By Hand - broadcast
Decomposing Agent	40 L/ha	By Hand – foliar spray
Humates	5 kg/ha	By Hand- broadcast
Soil Microbes	100 L/ha	By Hand – foliar spray
Brown manure lupin (desiccated in spring 2003)	5 t/ha	Brown manure spring 2003
Western Minerals Package (WMF)		
Dolomite	650 kg/ha	By Hand – prior to seeding
Granular Fertiliser	107 kg/ha	At seeding
UAN	60 L/ha	Pre-emergent
Top Dress WMF granular	40 kg/ha	6 weeks after seeding
WMF Nitrogold/SOP mix	40 kg/ha	8 weeks after seeding
Trichoderma microbes	120 L/ha	Foliar spray 21days after emergence
Control (harvested lupins in 2003)		

Treatments -

1. Control. All control plots no tillage
2. Control + Humates
3. Control + Zeolite
4. Control + Microbes (foliar application)
5. Control + Humates + Zeolite + Microbes (foliar application)
6. Brown manure Lupin. All BM plots no till
7. Brown manure Lupin + Humates
8. Brown manure Lupin + Zeolite
9. Brown manure Lupin + Microbes
10. Brown manure Lupin + Humates + Zeolite + Microbes
11. Tilled soil + Load up organic matter (20 t/ha)
12. Tilled soil
13. Tilled soil + Load up organic matter (20 t/ha)
14. Tilled soil + load up organic matter (20 t/ha) + decomposing agent
15. Incorporate Stubble using tillage (i.e. Control plot for 11-14 above)-
16. Incorporate Stubble + decomposing agent
18. Western Mineral Fertiliser Package

Results:

The total growing season rainfall was 277.4 mm. The rainfall limited yield potential of 3.3 t/ha was based on the French Schultz equation and was calculated using a factor of 20 kg of grain per mm of rainfall, and an evaporation figure of 110 mm for the season. The highest yielding treatments in this trial were higher than the calculated yield potential, suggesting the treatments imposed were able to fully utilise all available rainfall (Fig. 1). It is possible that treatment differences may have been bigger given a higher rainfall year.

The amendment of soil with organic matter had the largest effect on grain yield in this trial, with brown manure treatments demonstrating the highest yield (Fig. 1). In this trial, no significant effect was observed from the range of products applied, although yields were approximately 8% higher than control plots. Grain yield in plots receiving the Western Mineral Fertiliser package were similar to the best yielding treatments, however it must be noted that this treatment received additional N.

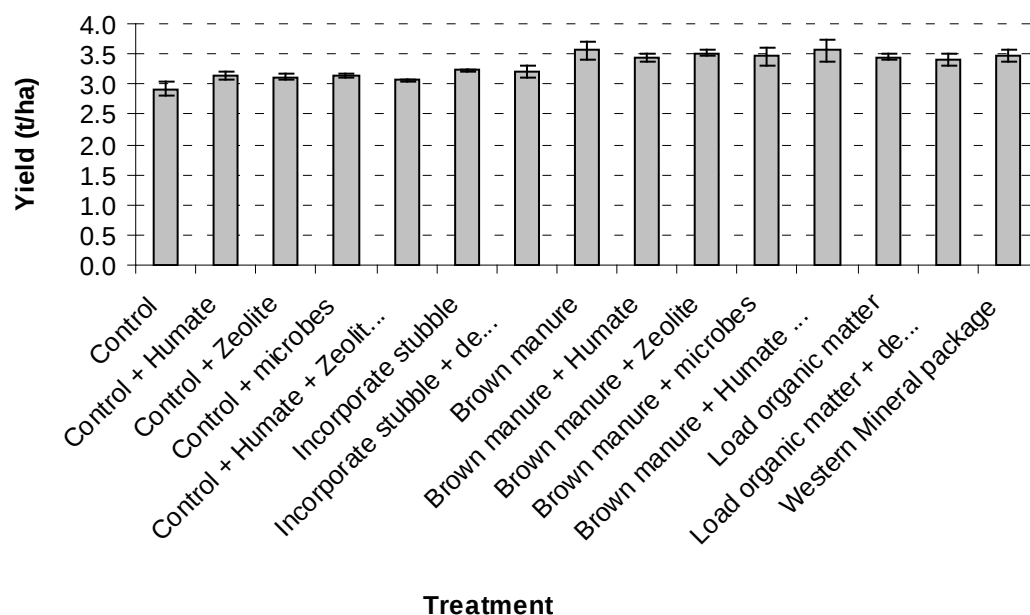


Figure 1: Grain yield (t/ha) of Wyalkatchem wheat grown in 2004 under treatments imposed at the long term Liebe trial site. Capped bars represent standard error (n=3).

Approximately 20% more heads/m² were observed on the brown manure and organic matter treatments (Table 1), This suggests a higher tillering capacity and/or less abortion of tillers, resulting in the higher yield when compared with the other treatments. Rain protein ranged from 9.4 to 12.2% (Table 1) and was marginally higher in both the brown manure and organic matter treatments. Total N uptake (calculated from grain component only) was also higher in treatments high in organic matter (Table 1), suggesting greater N availability in these plots.

Table 1: Grain yield components of Wyalkatchem wheat grown in 2004 under treatments imposed at the long term Liebe trial site.

Treatment Averages	Yield (t/ha)	Harvest index (%)	Hectolitre weight (g)	Protein (%)	N uptake (kg N ha)	Head no./m ²	Grain no/head
Brown Manure	3.56	42.49	82.89	10.85	386.3	209.03	25.94
BM +Humates + Zeolites + Microbes	3.56	41.65	82.75	10.68	380.2	221.11	21.76
BM + Zeolite	3.52	41.87	83.11	11.09	390.4	200.97	25.46
Western Mineral package	3.47	42.74	83.07	10.91	378.6	181.53	27.38
BM + Microbes	3.46	41.89	83.64	10.8	373.7	198.61	23.05
BM+ Humates	3.44	42.94	82.66	10.89	374.6	211.81	24.61
Load-up organic matter	3.44	42.25	82.87	11.43	393.2	194.03	21.91
Load-up organic matter + decomp agent	3.41	42.8	82.07	12.19	415.7	213.33	23.31
Incorporate stubble	3.23	41	83.03	9.4	303.6	165.69	24.31
Incorporate stubble + decomposing agent	3.20	42.72	83.03	10.02	320.6	167.78	25.71
Control + Humates	3.14	44.51	83.48	9.99	313.7	184.38	24.65
Control + microbes	3.14	41.47	82.12	10.7	335.7	176.67	24.25
Control +Zeolite	3.12	42.29	82.38	9.78	305.1	169.72	24.96
Control + Humates + Zeolites + Microbes	3.06	40.57	82.93	9.8	299.9	170.69	23.74
Control	2.91	41.68	83.16	9.61	279.7	167.36	24.57

Summary:

- Results show that there was a significant increase in grain yield and protein level for the brown manure and organic matter treatments.
- Brown manure and organic matter treatments showed ~20% increase in productive heads, possibly due to improved tillering and/or less dropping of tillers.
- The main treatments possibly overshadowed any benefits from the other treatments aimed to encourage microbial activity. This is the first year of the trial and increasing soil biological fertility is a long-term process.
- This trial is scheduled to continue until 2010 aimed at increasing soil water storage and biological soil fertility.
- It is anticipated that further data, including the effect of treatments on biological parameters will be available and once processed will be published in subsequent newsletters.

Technically Reviewed by: Fran Hoyle, DAWA

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