

Liebe Group Soil Biology Trial

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Key Messages

- Organic matter treatments showed greater early vigour, but this was not reflected in yield due to the dry season.

Aim

To investigate the potential of organic matter inputs to increase yield and improve soil health.

Background

This long term trial was established in 2003 to investigate how soil biology and carbon affect crop yield and soil health.

The trial site was selected as it had no significant chemical or physical soil constraints, therefore capacity to increase grain production through improved moisture conservation and enhanced soil biota can be demonstrated.

The trial aims to understand how agronomic factors such as yield and grain quality are affected by organic matter (OM) breakdown and cycling. Although the application of 20 t/ha of organic matter is not practical in a commercial farming enterprise this treatment is designed to demonstrate the potential upper level of organic carbon for sandy soils in our environment. The plots have now received a total of 80 t/ha of organic matter across four separate applications (2003, 2006, 2010, 2012) of chaff. Future modelling will determine whether the soil is nearing its upper soil organic carbon capacity.

Trial Details

Property	Long Term Research Site, Buntine
Plot size & replication	10.5m x 80m x 3 replicates
Soil type	Deep yellow sand
Soil pH (CaCl₂)	Topsoil: 6.0 Subsoil 4.6
EC (dS/m)	0.1
Sowing date	06/05/2014
Seeding rate	78 kg/ha
Paddock rotation	2010 wheat, 2011 wheat, 2012 canola, 2013 barley
Fertiliser	None
Herbicides & pesticides	03/04/2014: 1 L/ha Roundup UltraMAX, 300 mL/ha Ester 680, 100 mL/ha Garlon 06/05/2014: 2 L/ha Spray.Seed, 0.5 L/ha Diuron, 0.5 L/ha Dual Gold 30/06/2014: 500 g/ha Diuron, 140 g/ha Cadence, 1.5 L/ha Precept, 1 % Hasten
Growing Season Rainfall	185mm

2013 Treatment List

- Control (minimum till with knife points and full stubble retention).
- Tilled soil using offset discs.
- Organic matter (chaff is applied once every 3 years last applied 2012 at rate of 20 t/ha; tilled with offset discs).
- Organic matter run down (plots were chaff was previously applied in 2003 & 2006 but not since).
- Burnt (stubble burnt annually in March; minimum till).

Trial History

Year	Crop type	Yield range	Treatment notes
2003	Lupin	None recorded	Set up phase: 20 t/ha barley chaff applied, lupin crop brown manured.
2004	Wheat (cv. Wyalkatchem)	2.9-3.5 t/ha	Brown manuring and addition of 20 t/ha organic matter increased yield by 18-22%.
2005	Wheat (cv. Wyalkatchem)	2-2.8 t/ha	Burnt plots yielded 25% higher than control.
2006	Lupins	None recorded	Set up phase: 20 t/ha canola chaff applied, brown manure.
2007	Wheat – sprayed out	None recorded	
2008	Wheat (cv. Wyalkatchem)	2.4-3.4 t/ha	Addition of organic matter increased yield by 23% compared to control.
2009	Lupin	1.5 t/ha	Set up phase.
2010	Wheat (cv. Magenta)	2.5-1.9 t/ha	20 t/ha chaff applied. No significant yield difference between treatments.
2011	Wheat (cv. Wyalkatchem)	3-3.8 t/ha	No significant difference in yield.
2012	Canola (cv. Telfer)	0.7-0.9 t/ha	20 t/ha chaff applied.
2013	Barley (cv. Hindmarsh)	2.3-3.6 t/ha	Addition of organic matter increased yield.

Results

In 2014, the only results of significance are for the hectolitre weight of the oats from the 'Control'. This is possibly more a reflection of the dry season than a true reflection of the treatments. In previous years the organic matter treatments have resulted in over 1 t/ha yield increases as shown in Table 2 as the organic matter has made the soil more resilient.

Table 1: Yield and quality for oats comparing different tillage and stubble retention methods west of Buntine, 2014. Results followed by the same letter do not significantly differ from each other (P= 0.05).

Treatment	Protein (%)	Screenings (%)	Hectolitre Weight (%)
Brown Manure	12.2 ^a	5.72 ^a	51.34 ^b
Burnt	11.63 ^a	5.47 ^a	50.05 ^b
Control	11.27 ^a	4.2 ^a	53.25 ^a
Organic matter run down	12.3 ^a	5.7 ^a	49.85 ^b
Tilled soil	12.4 ^a	6.17 ^a	50.89 ^b
Organic matter	12.17 ^a	4.2 ^a	50.43 ^b
F - probability	0.095	0.151	0.022
LSD	0.874	1.828	1.869

Table 2: Yield results comparing different tillage and stubble retention methods west of Buntine from 2010 to 2014. Results followed by the same letter do not significantly differ from each other (P= 0.05).

Treatment	Yield Oats 2014 (t/ha)	Yield Barley 2013 (t/ha)	Yield Canola 2012 (t/ha)	Yield Wheat 2011 (t/ha)	Yield Wheat 2010 (t/ha)
Brown manure	0.49 ^a	2.74 ^{ab}	Brown manured	-	-
Control	0.68 ^a	2.62 ^{ab}	0.71 ^a	3.31 ^a	2.5 ^a
Tilled	0.54 ^a	2.88 ^b	0.78 ^{ab}	3.41 ^a	2.4 ^a
Tilled + OM	0.60 ^a	3.69 ^c	0.97 ^b	4.23 ^a	1.9 ^a
OM rundown	0.52 ^a	3.03 ^b	0.87 ^{ab}	4.00 ^a	2.5 ^a
Burnt	0.63 ^a	2.35 ^a	0.78 ^{ab}	3.78 ^a	2.4 ^a
LSD	NS	0.48	0.25	NS	NS

Comments

On an average rainfall year the Soil Biology Trial has proven that increased amounts of organic matter in the soil has increased the soils buffering ability by improving the soils water and nutrient holding capacity, leading to higher yielding crops. At the beginning of the season there was visually greater biomass at the site leading us to

hypothesize that the crop fell over due to the extra biomass running out of moisture with the extreme heat stress in August.

This biomass could not be sustained during the dry period in August; as such there was no difference in the treatments come harvest. This underlines that although in some of the previous dry seasons the added organic matter sites have shown significant yield increase compared to the control in extreme dry conditions that extra buffering ability can also reach critical levels and effect production.

It's probable that the organic matter treatments may have caused more N mineralisation in the soil, pushing the crop biomass, explaining how the 'Control' (ON) has a greater yield in this instance.

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