

Liebe Group Soil Biology Trial

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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	Topsoil: 6 Subsoil 4.6
EC (dS/m)	0.1
Sowing date	05/06/13
Seeding rate	60 kg/ha Hindmarsh
Fertiliser	05/06/13: 40kg/ha TSP 13/06/13: 40L/ha FlexiN
Paddock rotation	2012: canola, 2011: wheat, 2010: wheat
Herbicides	21/05/13: 2L/ha glyphosate 05/06/13: 2 L/ha SpraySeed, 2.5 L/ha BoxerGold, 130 g/ha metribuzin
Growing Season Rainfall	209mm

2012 Treatment List

1. Control (minimum till with knife points and full stubble retention).
2. Tilled soil using offset discs.
3. Organic matter (chaff is applied once every 3 years last applied 2012 at rate of 20 t/ha; tilled with offset discs).
4. Organic matter run down (plots where chaff was previously applied in 2003 & 2006 but not since).
5. 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. Tefler)	0.7-0.9 t/ha	20 t/ha chaff applied.
2013	Barley (cv. Hindmarsh)	2.3-3.6 t/ha	Addition on organic matter increased yield.

Results

In 2013, the addition of organic matter resulted in a yield increase of 1 t/ha above the control which is a minimum till, stubble retention system. Protein where organic matter was added was 12.63% which is significantly higher than other treatments. Screenings did not change significantly between treatments.

Table 1: Yield and quality for barely comparing different tillage and stubble retention methods west of Buntine, 2013. Results followed by the same letter do not significantly differ from each other (P=0.05).

Treatment	Yield (t/ha)	Protein (%)	Screenings (%)
Burnt	2.35 ^a	11 ^{ab}	32 ^a
Control	2.62 ^{ab}	9.7 ^a	24 ^a
Brown Manure	2.74 ^{ab}	10.4 ^a	29 ^a
Tilled soil	2.88 ^b	10.2 ^a	22 ^a
Organic matter run down	3.03 ^b	9.9 ^a	21 ^a
Organic matter	3.69 ^c	12.6 ^b	29 ^a
<i>LSD</i>	<i>0.48</i>	<i>1.7</i>	<i>NS</i>

Table 2: Soil nutrient test results from Long Term Research Site trial site in 2013. Note: Results followed by the same letter do not significantly differ from each other.

Treatment	Nitrate (mg/kg)	Phos (mg/kg)	Potassium (mg/kg)	Organic carbon (%)
Burnt	27 ^a	33 ^a	73 ^a	0.7 ^a
Control	30 ^a	31 ^a	72 ^a	0.7 ^a
Brown Manure	34 ^a	32 ^a	62 ^a	0.8 ^a
Tilled soil	32 ^a	34 ^a	76 ^a	0.9 ^a
Organic matter run down	36 ^a	45 ^b	102 ^a	0.9 ^a
Organic matter	63 ^b	54 ^b	242 ^b	1.3 ^b
<i>LSD</i>	<i>11</i>	<i>11</i>	<i>43</i>	<i>0.3</i>

Comments

Increased amounts of organic matter in the soil increase the soil's water holding capacity. In the case of this trial the organic matter areas yield gain could be attributed to more water being available. The other advantage of adding the organic matter is the increase in nutrients available to the plants, which is reflected in Table 2.

Acknowledgements

This project is supported by funding from the Australian Government. Historical funding from the Grains Research and Development Corporation.

Paper reviewed by: Daniel Murphy, UWA

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