

9. Healthy Soils

9.1 Healthy Soils For Sustainable Farms - Demonstration Sites, Vic

Location:

Three paired demonstration sites were established to evaluate soil health management practices at a local scale.

Demo sites were located at:

- Willaura (biological farming program)
- Shelford (controlled traffic)
- Inverleigh (stubble management)

Funding:

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Researchers:

Lou Ferrier (SFS), Tim Johnston (DPI, Geelong)

Author:

Tim Johnston, Soil Health Officer (Grains), DPI

Acknowledgements:

Many thanks for the following landholders: Graeme McCarthy (Willaura), Dave Stephens (Shelford) and Andrew Stoney (Inverleigh).

Rainfall (mm) April – November:

Willaura - 430 mm (2007 total – 581 mm)

Shelford - 411 mm - Sheoaks BoM station

Inverleigh – 393 mm (2007 total – 529 mm)

Summary of Findings:

Paired demonstration sites were selected by SFS in 2007 to evaluate soil health management practices at a local scale. The management practices included a biological farming program (Willaura), controlled traffic (Shelford) and stubble management (Inverleigh). All sites were sampled by DPI in January 2007 for initial biological condition and September 2007 for their soil chemical, physical and biological condition.

Preliminary observations from the January 2007 soil sampling suggest that leaving stubble standing compared with burning, and the application of commercial biological products may both have a significant impact on the amount of biological activity in the soil. Further monitoring is required to support these point-in-time measurements. It is anticipated that any changes in soil condition and crop yields will only be observed after an extended period, probably at least three years.

Background:

SFS have chosen 3 paired demonstration sites to characterize and monitor different farming practices and their impact on soil health. The management practices are:

- Biological Farming Program
- Controlled Traffic
- Stubble Management

The demo sites fit into the objectives of the HSSF project which are:

- Improve farmers' capacity to manage soil health issues
- Identify appropriate soil management strategies, both at a landscape and industry level
- Develop and deliver data and information packages for farmers
- Develop and promote industry based training packages

Southern Farming Systems, in collaboration with DPI Victoria, are delivering existing soil health information through farmer and adviser workshops in the higher rainfall zone.

▼ **Figure 9.1: Trial inputs**

Willaura - biological farming program,
Shelford - controlled traffic,
Inverleigh - stubble management

	Willaura		Shelford		Inverleigh			
	District Practice	Biological applications	Random Traffic	Controlled traffic	Burnt	Standing stubble	Incorp stubble	Wide row spacing
Pre-sowing inputs	Triflur 480 @ 1.2L/ha incorporated by sowing	Stubble digestion program; broadcast prescription fertilizer mix	For details please refer to Controlled Traffic section in this book		For details please refer to Controlled Traffic section in this book.			
Sowing date	26 th May 2007							
Crop type	Red wheat (cv Amarok)		Barley (cv Gairdner)		Canola (cv ATR Summit)			
Fertiliser rate	80 kg/ha MAP + Cu Zn, plus conventional seed dressing. 80kgN/ha 19 th Aug 2007.	70 kg/ha MAP+S, plus VAM seed dressing						
In-crop chemical applications	Amicide 600 @ 1L/ha in October	None						
In-crop fertilizer applications	None	Microbial foliar fertiliser @ 30 l/ha x 2						
Harvest date	25/1/08							



▲ Photo 9.1: Mark and Graeme at Willaura, Jan 07

◀ Photo 9.2: Lou Ferrier (SFS) undertaking soil sampling at Willaura.

Trial Design:**1. Willaura - biological farming program**

The HSSF demo site at Willaura was established by SFS in 2006. A biological farming practices program is being evaluated against current district practice. The trial has four replicates in a randomized block design. Each plot is 0.18ha in size (18 x 100m) and total site area is 1.44 ha. The soil type is highly variable and is described as a Vertic, Red Chromosol with a sandy clay loam topsoil over a medium clay.



▲ **Photo 9.3: Graeme McCarthy inspecting the health of his soil.**

2. Shelford - controlled traffic

The HSSF demo site at Shelford is at an existing SFS 'Concept Farm' established in 2007. The site features research into Controlled Traffic and Precision Agriculture as the key areas for farming systems development, including row spacings, stubble management, controlled traffic, subsoil hostilities and economic analyses of the different systems. The HSSF project is focusing on the controlled traffic aspects only. The soil type is described as a Vertic, Grey Sodosol with a fine sandy clay loam topsoil over a medium clay. Sodosols are the dominant soil type found on the volcanic basalt plains of the Western District.

3. Inverleigh - stubble management

The HSSF demo site at Inverleigh was established by SFS in 2005 to demonstrate different methods of stubble management on raised beds. The site has four replicates in a randomized block design. Each plot is 0.16ha in size (16 x 100m) and total site area is 4.48 ha. The HSSF project is evaluating four out of the seven treatments including; burning of stubble, standing stubble, stubble incorporation post-harvest and wide row spacings. The soil type is described as a Eutrophic, Brown Sodosol with a fine sandy loam topsoil over a medium clay. This soil is typical of the lighter soils associated with the Moorabool Viaduct Formation (MVF) that are found along the Bellarine Peninsula and west and north of Geelong.

Results:

▼ **Table 9.1: Willaura – Biological trial**

Treatment	Yield (t/ha)	Protein (%)	Test Weight (kg/hl)	Screenings (%)	TGW (g)
District Practice	3.74	13.18	75.34	1.55	40.73a
Biological	3.65	13.38	75.30	1.43	38.78b
LSD (P=0.05)	NSD	NSD	NSD	NSD	1.78
CV	3.02	3.08	0.03	32.78	2.0

Means followed by the same letter do not significantly differ.

LSD = Least significant difference. P = Probability. CV = Coefficient of variation. NSD = Not significantly different.

There were no significant differences between the yield of either treatments. However the district practice treatment had a significantly higher thousand grain weight to the biological treatment.

Soil biology and chemistry were first measured at all sites in January 2007, and subsequently in October 2007 (Spring). Preliminary results are only presented for the January 2007 biological sampling from Willaura and Inverleigh.

Soil biological tests undertaken in the laboratory include: Microbial biomass C & N (an indication of the amount of microbial activity), and Biolog® assay (indication of microbial diversity). Soil respiration assessments have also been undertaken in the field using the 'Soil Health Assessment kit'.

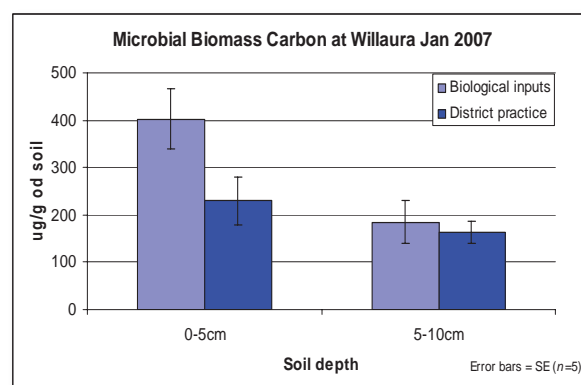
Willaura - biological farming program

The paddock was deep ripped in 2005 prior to the establishment of the trial site. Minimum tillage has been carried out in subsequent years. In 2006, minimal biological inputs were applied due to the dry seasonal conditions. In 2007, the biological input program included a stubble digestion program, a broadcast 'prescription' fertilizer mix, seeding program including VAM seed dressing and microbial brew, post emergent microbial foliar fertiliser sprays and no conventional pesticides.

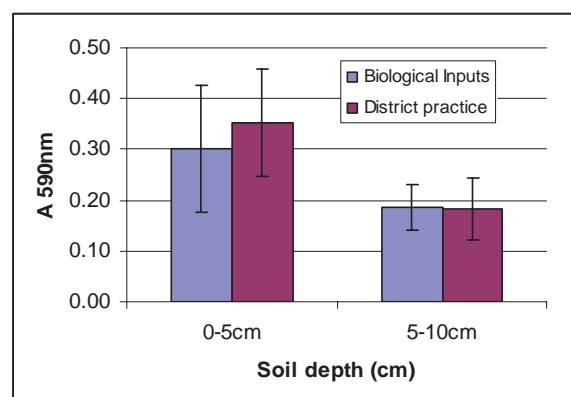
Biological laboratory tests (Microbial Biomass Carbon & Biolog® assay):

As expected, preliminary sampling in January 2007 indicated that the 0-5cm soils contained more Microbial Biomass Carbon (MBC) than the soils from 5-10cm under both treatments (Figure 9.2). Trends indicate that the biological input plots contained more MBC than the soils under district practice at both soil depths. The difference in the 0-5cm soils seems significant, indicating that the biological inputs may have contributed to an increase in the biological activity at this depth, but monitoring is required to support this point-in-time measurement.

The overall rate of carbon utilisation by the microbes in the soil samples can be estimated by the Average Well Colour Development (AWCD) from the Biolog® assay. Higher values indicate a more active and responsive population overall. In Figure 9.3, the AWCD indicates higher values in the 0-5cm surface soil, than in the corresponding 5-10cm depth. There is only slight variation between biological inputs and district practice, and considerable variation within each treatment.



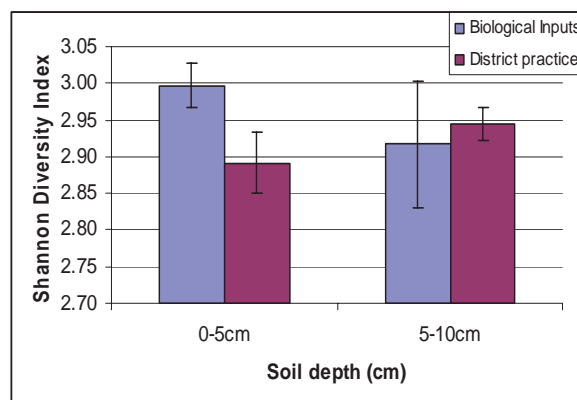
▲ Figure 9.2: Microbial Biomass Carbon (MBC) at Willaura, sampled January 2007.



Error bars = SE (n=5)

▲ Figure 9.3: Average Well Colour Development (AWCD) from Biolog analysis of Willaura soils, Summer 07.

The diversity of the microbial species can be estimated by the Shannon Diversity Index. A more diverse microbial community is likely to be more resilient to stresses and changes in the environment, and is often improved by above-ground plant diversity. This test is a direct measure of substrate (or food source) diversity, but can be used to estimate species diversity. The most diverse community was in the 0-5cm depth of the biological inputs treatment, and the least in the 0-5cm of the district practice paddock (Figure 9.4). This may be directly related to the application of the biological inputs to the surface soil, though further monitoring is essential to support this initial observation.



▲ Figure 9.4: Shannon Diversity Index from Biolog analysis of Willaura soils, Summer 07.

Shelford - controlled traffic

No soil biology, chemical or physical measurements are yet available.

Inverleigh - stubble retention

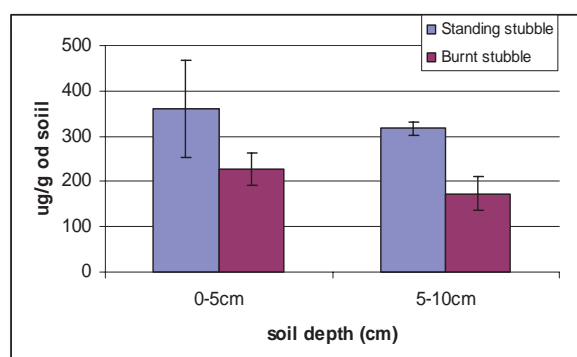
Currently only Microbial Biomass Carbon measurements collected in January 2007 are available for discussion. These measurements only compared burnt stubble versus standing stubble treatments.

Biological laboratory tests (Microbial Biomass Carbon only):

The standing stubble treatments contained more MBC than the soils under the burnt stubble plots, indicating that they may have more microbial activity at both soil depths. The difference in the 0-5cm soils seem significant, but monitoring is required to support this point-in-time measurement.

Trial Observations:

The dry seasonal conditions in 2006 and 2007 impacted on production at all sites. It is anticipated that all soil tests will be undertaken on an annual basis in Spring. As Spring is the preferred time for soil sampling, the January 2007 sampling data should be treated as preliminary.



▲ Figure 9.5: Microbial Biomass Carbon (MBC) at Inverleigh, sampled January 2007.

Other activities:

In addition to the Paired demonstration sites, various activities have been coordinated by the HSSF programme in 2007-08 including:

- Gordon Spoor Soil structure workshop, SFS Inverleigh, September 2007
- Preliminary module workshop for growers and advisers, SFS Inverleigh, December 2007,
- 'Understanding Soil Tests – Chemical' module workshop for advisers, SFS Inverleigh, February 2008.

Other soil health training sessions for advisers and growers to be held in 2008 include:

- Understanding Soil Health - general overview
- Understanding Your Soils
- Understanding Soil Structure
- Understanding Soil Tests - Chemical
- Understanding Soil Biology
- Managing Soil Organic Matter
- Managing Subsoil Constraints
- Managing Erosion