Soil health in practice: a closer look at sustainable soil management techniques

Deep ripping, subsoil manuring and cropping trials in the Pyramid Hill region

"Our soil... it's our greatest asset but it's also our greatest challenge." (Adam Gould)

Chris Leed and Adam Gould are both farmers and participants in the Pyramid Hill Group as part of the Farming for Sustainable Soils (FSS) Project.

Pyramid Hill is about an hour north of Bendigo. The area has a diversity of soil types—including lighter sandy soils and loams as well as red and dark clays—but is generally characterised as flat, heavy clay country. Landholders in the area experience a range of soil health challenges, including salinity and sodicity issues, shallow root zones and poor soil structure with lacking organic matter and moisture holding capacity.

Deeply aware of the value of soil health for the success of their farming enterprises, Chris and Adam both became involved in the FSS Project to share experiences and test new approaches to soil management. The Pyramid Hill FSS Group offered farmers like Chris and Adam the opportunity to prioritise and explore the soil

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The Farming for Sustainable Soils Project is funded by the Australian Government's National Landcare Program and delivered by the North Central Catchment Management Authority in collaboration with local farming communities.

health management issues most relevant to their community:

"It was quite exciting that we as a community group could focus on what we wanted to focus on and [...] what we're doing to improve our own properties." (Chris Leed)

Finding out what works - Chris Leed

Chris's family have been farming in the Pyramid Hill area since the 1870s, and he's had his own farm since 2000. His farming enterprise includes 800 hectares of predominantly winter cropping: "our main focus is growing barley, but in our rotation we grow canola and wheat. We run no stock, [with] a no till controlled traffic operation".

The soils on Chris's property are red and dark heavy clays, with neutral pH, but there's also some more alkaline sandy loam. Chris has previously dealt with salinity issues which subsided since the millennium drought, but his main soil health issues include shallow root depths and poor soil structure. Improving soil health is something he's been working on for a while: "we've spent a lot of time and effort and money on trying to improve soil structure and we'd already seen the benefits of that, but there's always more room to improve".

Pulse cropping trials

The Pyramid Hill FSS Group further investigated soil health issues experienced in the area, and a range of field trials were conducted on local farmers' properties. Building on previous cover cropping trials that Chris undertook in 2015, a pulse cropping trial was conducted on his property through the FSS Project:

"We have done some trial work here on this property - we looked at pulse growing last year, where we trialled all sorts of varieties of different crops to see what would grow in the area. It was a rewarding trial [...] seeing how that led to my current rotation."

"The funding from the FSS Project went towards having an independent trial conducted on my property - it meant that I could just provide the land and Birchip Cropping Group were contracted to come and do the work and do all the analysis and conduct the trial."

Chris Leed

Chris explains that this meant "we could get reliable information to see what actually worked". Without the FSS Group's support for the trial, he wouldn't have had the time or resources to manage and monitor it properly. Data collected through the trial has in turn influenced Chris's crop rotation decisions.

Chris is always working towards improving the productivity of his land - it's important that he gets an economic return. Soil health and profitability can certainly go hand-in-hand, but it's important to trial the techniques and approaches that are most suitable for different soil types, conditions and properties, with different crops and inputs. Testing what works on your own farm sometimes means that results are varied.

While the funded pulse trial didn't result in any significant benefits for the paddock it was conducted in, Chris says he has "seen the benefits in other paddocks where I have grown pulses - I've had to use very little nitrogen fertiliser to finish off a crop", saving him resources.

The trial led Chris to discover that chick peas don't grow so well on his property, "but fava beans did extremely well - they did four tonne a hectare on dryland". Chris had planted fava beans in his wheat crop - for nitrogen fixation and to encourage beneficial insect species. Using legumes like fava beans in crop rotations can be used to enhance stubble retention - which increases organic matter and improves soil structure and water retention.

Outcomes - soil health, productivity and community

The experiences and learnings of the FSS Project have had a range of benefits for Chris and other farmers in the Pyramid Hill Group - including social and community outcomes, as well as soil health and productivity improvements. For the Pyramid Hill Community Facilitator Adam Twigg, this was a key goal of the Group: "I wanted to get something that at the end that I could take to the Group and say with confidence that this has an actual benefit". Chris explains:

"As a result of going through what we have with FSS, we need to be more diligent with timing our farming operations - we can pick up through our productivity immensely."

"Just to see the results that individuals have seen on their own properties - that gathering of local knowledge I think was the greatest outcome."

"Breaking down barriers where people can get together for a feed and to talk about experiences - that's been the greatest thing about the Project. And that will continue on after the Group finishes up, that connection with others."

Pulse trials on Chris Leed's property

Sharing knowledge, giving things a go - Adam Gould

Adam says he's learned a lot from Chris through being involved in the Pyramid Hill FSS Group. Adam was keen to get together with other local farmers to share experiences and learnings:

"The most rewarding thing I've found is probably bringing all the farming community together who generally don't share a lot of their techniques and ideas [...] That has been a really, really pleasing thing about the Group - the sharing of knowledge, and people willing to give things a go."

"I think it's actually improved everyone's bottom line, the group in general [...] just better farming practices are being shared through the group have realty helped everything I think."

Canola paddock on Adam Gould's property, showing subsoil manuring on the left (with more foliage and flowering) and deep ripping on the right (with less plant growth)

Adam has lived and farmed in the Pyramid Hill area for 18 years. He's the cropping manager for a local farm and also owns his own property in Mitiamo. The soils he works with on a daily basis range from light, sandy country to heavy black clays. For Adam, the biggest challenges with soil health are water holding capacity, shallow root zones and lacking organic carbon:

"More healthy soil grows more cover and then we can hold more water - so it makes the decisions the next year for setting up the next crop easier [...] That's my biggest concern or challenge is to get everything to hold more water, to use water more efficiently."

"The shallow rooting zone is a real challenge with our poorer soils [...] To get roots to penetrate, we've got plenty of moisture underneath, but there's a real barren layer whether it's a sodic zone or salt."

Trials funded through the FSS Project have helped Adam overcome some of these soil constraints:

"It's a real challenge for us, trying to discover a method top get roots down deeper - hence why we've had a go at the subsoil manuring, some deep ripping, the tillage radish and then trying to get more cover on the top, trying to build it from there."

Adam Gould

Subsoil manuring and deep ripping

The trials conducted on Adam's property included subsoil manuring and deep ripping as comparison trials "to try to get a real indication of what was working":

"We deep ripped two of the sites exactly the same [...] and then we went through and put the chicken manure in a third of the site and left the other third of the site untouched. We put the same amount of chicken manure on top in the third site so we could tell whether it was actually the subsoil manuring doing the job, whether it was the ripping doing the job, or just the manuring doing it by itself."

The trials were conducted across hay crops, vetch and canola, with some clear results:

"It was very hard to do a cut and dry test for yield - but there were clear visual benefits. [We] cut some of the plants out and measured them and they were [much bigger in length] where it was subsoil manured. Where the chicken manure was just by itself, the canola certainly was stronger and flowered for longer. Where it was ripped by itself it was harder to see any real benefits in that first year."

The trials have continued and Adam has continued to observe the results:

"This year just gone, there was about 700 kilograms in yield benefit where the subsoil manuring was done - and 200 kilograms where it was deep ripped. There may have actually been a penalty where the manure was by itself."

Deep ripping

Subsoil manuring trial on Adam Gould's property

Machine used for subsoil manuring

Getting plants to work for you - tillage radish

A cropping trial with tillage radish was also conducted on Adam's property through the FSS Project. Using tillage radish as a cover crop can help to break up soils, encouraging improved soil structure through more organic matter and water retention.

"We sowed tillage radish right beside the barley crop [...] down beside the barley, through some really, really saline soils and troublesome soils."

Soils scientist Christian Bannan and FSS participants gathered around a soil pit at the site of the subsoil manuring trial on Adam Gould's property

Adam explains that coming into spring, "we blew them out and some of them had created some quite good tubers". The tillage radish "definitely got stuck into some of the soil which was quite surprising, particularly on the salty ground where they probably shouldn't have grown at all, they got in and had a bit of a crack".

Reflecting on the overall success of the trials and his involvement in the FSS Project, Adam says:

"I feel that I've got plenty out of it and got a bit of a reward by having the trials done on my farm - I really appreciated that, it's been a good program I thought."

"Most things are very slow in soil to happen - so what we gained out of a few of the trials I think was really, really valuable."

Tillage radish

The way forward

Despite barriers remaining - such as finances, tough climatic conditions and historic soil health issues to overcome - Chris and Adam have goals for continuing to improve soil health going forward.

The FSS Project has helped Chris understand the value of moisture holding capacity for soil health and the resilience of his crops: "through the FSS Group I've realised the benefit of water to my business and I've been developing that over the last three years and I will continue to do so".

For Adam, who is managing varying soil types within and across paddocks, "variable rate mapping is our number one priority now - to try and identify our problems and see how we can fix those problems".

"Our soil... it is our greatest asset but it's also our greatest challenge." (Adam Gould)

"It's about doing as much as we can within our parameters." (Chris Leed)

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