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SOIL CARBON CASE STUDY

with Andrew Dickie

Submitted by:
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Introduction

The Soil Carbon project was developed in response to knowledge gaps and ran from 2012-2015, with funding from the Australian Government's Department of Agriculture Action on the Ground program. Our projects partners were Murray Local Land Services, North East Catchment Management Authority and the Victorian Irrigated Cropping Council.

In addition, we are thankful to the Foundation for Rural and Regional Renewal (FRRR), and the William Buckland Foundation, for providing the opportunity to better understand key drivers in managing carbon in farming systems through the publication of the research and farmer case studies to showcase the outcomes from the project.

Key Learnings

- During the first few years of application, post-harvest application of fertilizer does not have a statistically measurable impact on soil organic carbon (SOC). There may be a positive result after 5-10 years but the monetary value of that stored carbon would have to be significant to recoup the costs of applying fertilizer over this time.
- There are benefits in continuing to focus on maintaining soil cover and soil organic matter, even if soil organic carbon levels do not increase, maintaining high microbial activity will have many physical, chemical, and biological benefits that go beyond the actual soil organic carbon value.

Background

With the help of funding through FRRR we are updating the outcomes from the Soil Carbon project. Back in 2018 we did a case study with Andrew Dickie, who farms at Youanmite, in Victoria. His farm has mostly clay loams with some granite loams soil types. In this case study we reviewed how Andrew's soil carbon management practices have changed in his farming system over the past 5 years.

Farmer

Andrew Dickie

Location

Youanmite

Q. Describe your farming enterprise?

In the past 5 years we have increased our cropping area from 1300ha to 2000ha and removed the sheep enterprise from our business.

Q. Describe your cropping sequence /rotation?

Our continuous cropping runs on a four-year rotation. Wheat, Canola, Wheat, and then either vetch or faba beans. Generally, we crop 50% of our area in wheat, 25% in canola and 25% in vetch / faba beans.

Q. If there are any pulses or legumes, what are they and what are your perceived and real benefits from including a pulse/legume?

Nitrogen fixation is the main benefit for us, you can't beat natural nitrogen, especially with the high costs of fertilizer the past couple of years. We had a deep nitrogen soil test last year show us that after brown manure vetch we would have enough nitrogen in the soil to grow a 6.5t/ha wheat crop with 11.5% protein.

In my opinion, a wheat canola wheat rotation that relies on urea as the only source of nitrogen may not be sustainable in the longer term.

Legumes/pulses also offer us different weed control options and there is the opportunity to bale vetch for another source of income if the faba bean market is poor.

Q. If there are any pastures used, what is the composition of the pasture, and how long does your pasture phase go for?

We don't currently have any pastures. In the future I have thought of the possibility of tightening the rotation to wheat – vetch or wheat – canola – vetch and if the costs of inputs keep rising this may be something that we consider doing. However, the wheat - vetch rotation would only be financially viable for a business with low levels of debt, and we would have to run some sheep on the vetch for an extra income source. Having said that, it may significantly reduce chemical and fertilizer input costs.

Q. What range in soil carbon values do you have across your property (0-10cm) and how have these changed in recent years?

Our soil carbon is sitting at around 1.3 – 1.9%. These values have remained stable over the last 15 years.

Q. What value do you place on maintaining/ improving soil carbon in your cropping system? And how do you do this?

We place a high value on maintaining our soil carbon. Soil carbon and fertility is the engine room of our farming system. I was hoping that our values would have been above 2% across the farm, in the recent soil tests completed. I am not sure what more we can do to try and increase our carbon levels but 2-3% soil carbon in a continuous cropping system is the aim.

Currently we use a Gason stubble mulcher and then a Lemken Ruben 10 disc harrow to incorporate the stubble into the soil as soon as we can after harvest.

At sowing we broadcast our seed with a Vicon spreader and integrate it into the soil with a prickle chain for small seeds like canola, a Kelly chain for wheat and vetch and the Lemken Ruben 10 disc machine for large seeds like faba beans. Because we use the Lemken to integrate the faba beans at sowing time we do not use it after harvest.

Q. Are you likely to change your management practices to attempt to improve soil carbon (if not unprofitable?)

Not at this stage. I believe that what we are doing currently is as good as we can do without completely changing our farming system.

For now, we are going to continue what we are doing, and we are happy that our soil carbon levels are being maintained.

Q. What benefit do you see the CSI project having to your enterprise?

It will be a valuable benchmarking tool for us to have soil samples taken and analyzed from the same spot over a period of time.

Hopefully having evidence of our soil carbon levels and our practices that we do to build a sustainable farming system will give us a bit of insurance in the future if the government decide to bring in policies for carbon in farming systems.

Q. Have you trialed any new ideas or approaches regarding plant systems, rotations, novel species, cover* or companion crops*?

We haven't tried anything in the past 5 years. Companion cropping is an interesting avenue, and we are watching some other farmers in the area closely to see how successful their on-farm trials are. One farmer has sown 15kg of wheat with 40kg of vetch and sprayed the vetch out recently (late August) to allow the wheat to finish for harvest.

I don't think we get enough reliable summer rainfall in a normal year to grow cover crops.

Q. Have you changed any practices to try to reduce your GHG emissions?

No. It is too hard for us to measure. I am more concerned about building a sustainable system overall than specifically reducing our emissions. We don't burn stubbles which would help us have lower emissions overall as well as placing a high value on soil carbon in our system.

Q. Do you change your carbon management practices based on the weather conditions?

The only issue that we get is on the retained stubbles where we are planting faba beans, if we have a wet autumn then trafficability becomes difficult.

Summary

- The inclusion a pasture phase and pulses/legumes in the cropping rotation is important to maintain soil organic matter and soil cover which promotes high microbial activity which has benefits that exceed the actual soil organic carbon value.
- Applying fertiliser after harvest is a long-term investment, it will take at least 5-10 years to see an increase in soil carbon levels and even then, it may not provide return on investment if the monetary value of soil carbon is insufficient.
- Soil carbon levels may vary based on soil type

Gaps/Barriers to Progress

- How do soil types affect soil carbon levels?
- Is there a limit to how high soil carbon levels can go in a continuous cropping system – is a target of 3% carbon realistic?
- Is there a significant connection between soil organic carbon and soil nitrogen levels?
- What will soil carbon levels need to be at for us to claim carbon neutrality in the future?
- Research on cover crops and if they increase soil carbon.
- More research on the benefits of companion cropping in Australian farming systems.
- Method for measuring and selling carbon credits for Australian farmers.

*Companion cropping is planting and growing two or more crops together in the same paddock, at the same time.
*Cover cropping is any non-cash crop grown in addition to the primary cash crop, but not at the same time.

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