COOL SOIL INITIATIVE CASE STUDY - PETER CAMPBELL

KEY LEARNINGS

- During the first few years of application, post-harvest application of fertiliser 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 fertiliser over this time.
- There are benefits in continuing to focus on maintaining soil cover and soil organic matter, even if SOC levels do not increase. Maintaining high microbial activity will have many physical, chemical, and biological benefits that go beyond the actual SOC value.

BACKGROUND

With the help of funding through FRRR we are updating the outcomes from the Soil Carbon project. In 2018 we conducted a case study with Peter Campbell, who farms at Henty on a mixture of red brown earths and yellow podzolic soil types. In this case study we reviewed how Peter's soil carbon management practices have changed in his farming system over the past five years.

What is your farming enterprise?

We run a mixed farm with sheep and cropping over 1200ha. We currently have around 2800 breeding merino ewes and 2000 lambs.

Describe your cropping sequence or rotation?

Our cropping rotation is flexible. Generally, we start with a pasture phase, followed by canola followed by wheat, then barley, oats, triticale, narrow leaf lupins or arrowleaf clover. We rarely have two consecutive wheat crops and try to put a pulse in the middle of the five-year cropping rotation.

How do you manage your stubbles?

We try to retain our stubbles 100% across the farm. This year was the first year in 20 years that we had to burn paddocks because of the large stubble load and high moisture in the soil. If we didn't burn, then we would have had yield penalties and possibly would not have been able to sow in some paddocks due to how wet they were. Although we try to keep our stubbles and sow through them you must be flexible in your approach.

What pulse do you sow and what are your perceived and real benefits from including a pulse?

I have sown faba beans and albus lupins but found the grain yield to be unreliable so now we stick to narrow leaf lupins. The benefits of growing a pulse include providing a disease break and lower costs through not having to apply nitrogen and sometimes phosphorous.

We use an aerial seeded clover such as arrowleaf in the middle of the cropping phase for a disease break and nitrogen input.

Do you use pastures, and what is the composition of the pasture, and how long does your pasture phase go for?

We have a pasture phase of 7-10 years in paddocks. Generally, the paddocks with poor draining soil types stay in pasture longer than those that drain more freely.

We use a lucerne sub-clover mix on the free draining soils and either phalaris or tall fescue and sub-clover on the poorly drained soils.

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

Our aim is to have 2 to 2.5% carbon in our soils. Some paddocks have over 3% carbon.

There seems to be variation, again based on soil types. The poorly drained soil average around 2.2% carbon in the top 10cm, possibly due to a longer pasture phase, with the better soil types struggling to reach 2%, again possibly because of more intensive cropping regime.

When testing it is important to sample at the same GPS point each time and at the same time of year to allow a fair comparison.

What value do you place on maintaining or improving soil carbon in your cropping system? How do you do this?

Maintaining and improving our soil carbon levels is very valuable to us. It is important as high carbon levels are linked with good soil fertility and allows us to reduce our nitrogen fertiliser use.

We preserve and increase our soil carbon through stubble retention, through having a zero-tillage system and using pastures in our rotation.

Healthy pastures need healthy soils and lime is a critical component to correct acidity.

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

We could currently put fertiliser on cereal stubbles to prevent the tie-up of nitrogen while the stubbles are being broken down, however for us I don't feel like it is a financially viable option.

What benefit do you see the Cool Soil Initiative project has to your enterprise?

I was a bit disappointed with our soil test results as we were only around the mid-range of values. It will be interesting to see if they are different when we test again as there are some anomalies compared to our regular soil testing program.

From the project, I would like to see a methodology developed for Australian farmers around how we can market and sell our carbon.

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

We have tried companion cropping forage radish with winter cereals for grazing. We didn't identify any real benefit for soil health however radish provides good nutritional value for the sheep when combined with a cereal.

I am interested in cover crops however sceptical about the benefits to the soil compared to simply retaining stubbles, which provides biota habitat and protection from erosion.

Have you changed any practices to try to reduce your greenhouse gas emissions?

No, not specifically. We have planted thousands of trees on our farm which I believe helps reduce the GHG emissions. Not burning stubbles will help too. It is hard to reduce livestock emissions especially when they are out in a paddock and not in a feedlot as you can't control their diet.

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

Yes, we are flexible in our approach depending on how the season is going. 2022 is the first year over a 20-year period we have had to burn a number of stubbles.

To prevent nitrogen volatilisation, we avoid spreading urea onto waterlogged soils and we don't apply it in the summer months. Like most growers we tend to wait until there is a strong forecast for rain before we apply any fertiliser.

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.

EXTENSION AND PRACTICAL KNOWLEDGE OPPORTUNITIES

- 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 soil carbon 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.

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 Catch 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 farmers case studies to showcase the outcomes from the project.

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