



Piecing together a soil health jigsaw puzzle



Marian cane grower Simon Mattsson is looking to plant diversity – and now animal diversity – to improve soil health on his farm.

BY BRAD PFEFFER

It was 15 years ago when Simon Mattsson started to seriously question his soil's organic carbon levels.

He had been green cane trash blanketing (GCTB) for a decade and remembered the initial promises with GCTB: it would retain moisture, suppress weeds, and increase organic carbon.

"We had been an early adopter of green cane trash blanketing, starting in 1986, but there was nothing happening with our soil," he said. "If anything, our soil carbon levels were going backwards."

Striving for the answer to this question, and to find a better way to run the family's Central Region cane farm, has led to a long journey that involved a Nuffield Scholarship, travel to about a dozen countries, countless trials, scientific publications and collaborations, and an ongoing passion for sharing the message on soil health.

One of the major turning points came when he was thousands of kilometres from home, in a field in North Dakota.

He was on a grain farm and talking to the farmer about both plant diversity and animal diversity, and he quickly realised that the principle applied all the way back home to Marian.

"In talking to farmers overseas, I saw the power and necessity of plant diversity," he said. "Without plant diversity you will not have biological diversity, which enables nutrient cycling."

"In the sugar industry, there is a big focus on compost, mill mud and ameliorants, which work if you can afford them, but I saw live roots as the answer for addressing biological function."

In 2015, that led to multi-species fallow crops (eight) and intercropping with crops such as sunflowers.

Having worked on that process for a few years, he is now taking the next step that he saw overseas. In 2018, his fallow had an electric fence around it, and inside were 33 grown cattle and five calves going through high-intensity rotational grazing and enjoying the mixed-species fallow crop.

He'd grown up with cattle and had seen the process at work overseas, but had also considered other options such as pigs, sheep and goats.

He decided on cattle for ease of management and processing, and for this same reason opted to breed for the store market.

"If I were to buy weaners and fatten them, most of the time I would be buying animals that have never seen an electric fence," he said. "So I'd be retraining animals all the time, and good neighbours might quickly turn into cranky neighbours if my cattle escape into their paddocks."

"The cattle – Droughtmaster cross – have developed a good respect for the electric fence and respect it far more than they would barbed wire. I've only had one escape, and she just waited on the other side for me the next morning."

The electric fence is also much easier to put up and take down for the cane cycle.

The fallow is about 26 hectares and the cattle are in a section of about 80 square metres for each graze. The idea is that they will go over a section three times, and after the third round the biomass will be almost fully grazed before the ground goes back to cane in the spring. Using a small area ensures even grazing and spread of manure.

The cattle are moved generally every day, but may be left a little longer on the third round to ensure the cover crop is grazed down. The grazing starts in March, and finishes around July/August, which was when CaneConnection visited.

Including the solar, batteries, fencing, and other equipment, the investment was in the order of \$30,000. He also has a portable water source that is moved with the cattle so that they aren't creating pads.

He said that it was a way of capturing value, and helped avoid some of the seasonal risk that came with a single crop of legumes.

There are 14 different species in the fallow crop in the paddock, plus some volunteer cane. "I am looking for plants that are palatable and also serve a biological function with soil health.

"Sunflowers aren't as palatable as other species, but they are definitely in the mix because they are a very good host of mycorrhizal fungi, which help their host plant take up phosphorous."

PLANT DIVERSITY

We've all seen the spectacular photographs in farming magazines: arrow straight rows, not a weed in sight, and a bright-green crop that looks like the top of a billiard table.

For Simon Mattson, he knows that those crops look impressive, but they don't necessarily pay off the mortgage in the long term.

He is much more worried about what looks good under the surface with a microscope than what looks good on top.

Getting things right underneath will lead to getting things right on top, he says.

When he points to the hills overlooking his property, he makes the point that nowhere in nature do plants look like they do on the cover of a farm journal.

"After my Nuffield Scholarship, I started with adding plant diversity and I knew that in the sugar industry it is now common to find agricultural soils with less than one percent carbon content."

He'd seen the effects of a monoculture for himself.

"This place has ground that has been farmed for over 100 years and was some of the earliest to be opened up for the Marian Mill. It also has country that I opened up 30 years ago. That new country grew good cane at first, but it has now become pretty much as bad as the country growing cane for 100 years."

This has been a topic of discussion at recent Soil Health Masterclasses, which were funded by SRA across the industry, and Simon presented at, along with others including Dr Graham Stirling, Dr Anthony Young, Dr Jay Anderson, and southern region growers, Mr Ashley Peterson and Mr Tony Chapman.

The Masterclasses discussed topics that Simon is passionate about, digging deeper into the biology, chemistry and physical properties of a healthy soil.

Similar work, separate to that which Simon has undertaken on his farm, is continuing under an integrated soil health research program at SRA, spanning across multiple research projects. This includes research that will examine issues such as companion cropping and mixed-species fallow crops, as well as looking for strategies to reduce the competition effects that may reduce cane yield.

For Simon, he is continuing with his mixed species fallow crops, and also intercropping with sunflowers to continue with the diversity into the crop cycle, in the quest to improve soil biology and health.

In a paper that Simon co-authored with Dr Graham Stirling for the Australian Society of Sugarcane Technologists (ASSCT) conference this year, they found that three years of eight-species intercropping increased soil carbon levels by about 15 percent, although this effect was not statistically significant.

"The nematode and carbon results suggest that long-term benefits are likely to be obtained by incorporating multi-species intercropping into the sugarcane farming system," they wrote in their paper.

They also found that where sunflower was the intercrop species, DNA tests on the soil showed the soil was more heavily colonised with a more diverse range of mycorrhizal fungi.

"Collectively, these results suggest that intercropping improves the biological health of sugarcane soils. However, long-term field trials are required to substantiate the benefits obtained; assess the impact of intercropping on sugarcane

yield; confirm that intercropping improves soil carbon levels; and fully evaluate its effects on soil biodiversity," they wrote.

Some of the work in this trial through Dr Graham Stirling was supported through an SRA-funded research project.

In summary, Simon says improving soil health is a long-term equation that involves complex factors all working together.

He cites an example for some of his country moving from 5.5-6 pH to now 6.5 pH, as well as organic carbons between 0.8 and 1.5, whereas previously they were less than 1.

There is also current work underway between SRA and the NSW Department of Primary Industries working with mixed species fallows and looking at the impacts on soil indicators: chemical, physical and biological.

NSW-DPI will be measuring soil carbon pools to try and understand what is happening at different sites.

Also, SRA is investing in a project with CSIRO on a diagnostic for root health to measure the size and functional root systems in sugarcane associated with soil health/cover cropping sites, and SRA Researcher Dr Rob Magarey will be using the PreDicta platform to look at soil health issues.

"Yes, I am making a difference, but it is also difficult to clearly demonstrate that it has reliably translated into yield increases," Simon said.

However, he is particularly proud of one example in 2017, where a crop of plant cane Q240[®] on single-row two metre centres yielded 171 tonnes per hectare at 12.2 PRS cut in early July, marking his best ever crop.

"We are starting from a low base in the sugar industry and some of what I am doing is controversial, but I am truly passionate that plant diversity to influence soil biology is the key and offers huge potential for our industry." ■

**For more information,
contact Simon Mattsson
E mattsson@mcs.net.au**

(Over page - left) Not something you see often on a cane farm – high intensity cell grazing in fallow paddocks. (Over page - top right) All this work is in the interest of improving soil health. (Middle) Intercropping of sunflowers with cane. (Bottom right) The electric fencing, including solar and batteries, cost about \$30,000.