SANTFA
CONSERVATION AGRICULTURE IN ACTION

E-Newsletter
Summer 2020

PRESIDENTS REPORT

Well, hasn't 2020 proved to be an interesting ride! Hopefully, however, harvest is providing a chance for some normality, as we go through the motions of getting the grain to the silos with as few breakdowns and complications as possible. The rain that finally arrived in spring was a welcome relief to many, with some areas lucky to receive good falls. Unfortunately, it did cause headaches for hay producers – once again, proving the old adage that you can't have good grain and hay in the same season.

COVID-19 has certainly brought its challenges this year and has limited SANTFA's opportunities to hold face-to-face conferences and crop tours. Instead, we have sought new ways to connect with our members during these socially distanced times, including the successful Conference Webinar series that was presented live in July and August. An exceptional array of speakers presented on a range of topics, including biological seed coatings, improving water efficiencies and preserving soil biology. If you missed the webinars, or would like to listen to the speakers again, the presentations will be available on a new members-only portal to be launched early next year.

The new portal is an exciting development for SANTFA and will strengthen our endeavours to keep members informed. Not only will it provide access to the latest SANTFA research and other important news, including video content, but it will also allow for easy renewal and change of membership details. Information packs on how to access the portal will be provided to members in coming weeks … please ensure we have your current email contact details so you don't miss out on access to this new initiative.
In the meantime, we hope you enjoy this latest edition of SANTFA's E-News. There's some interesting updates on Rick Llewelyn's virtual fencing trials and the first article in a two-part series from soils expert Joel Williamson. Also, we provide information on controlled traffic farming (CTF) in hay production, which is particularly relevant given our recent wet baling conditions. Thank you to Vic-NoTill for providing many of the articles for this E-News edition, which are sure to be of keen interest to SA farmers.

Finally, as we head towards the end of the year, I would like to thank the current SANTFA Board, along with Research and Development Manager Greg Butler, for their tireless efforts during our Association's restructure. The input from each of them has been invaluable as we navigate a new way of journeying with farmers to improve their systems and profitability into the future. We look forward to sharing our new vision with you over the course of next year.

I wish you, and your families, a safe and happy Christmas. As always, we welcome your thoughts and feedback – our contact details can be found at www.santfa.com.au if you wish to get in touch.

Happy reading!

Callum March

SANTFA President

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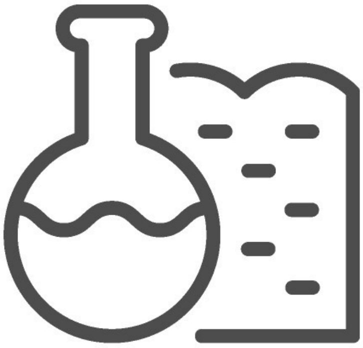
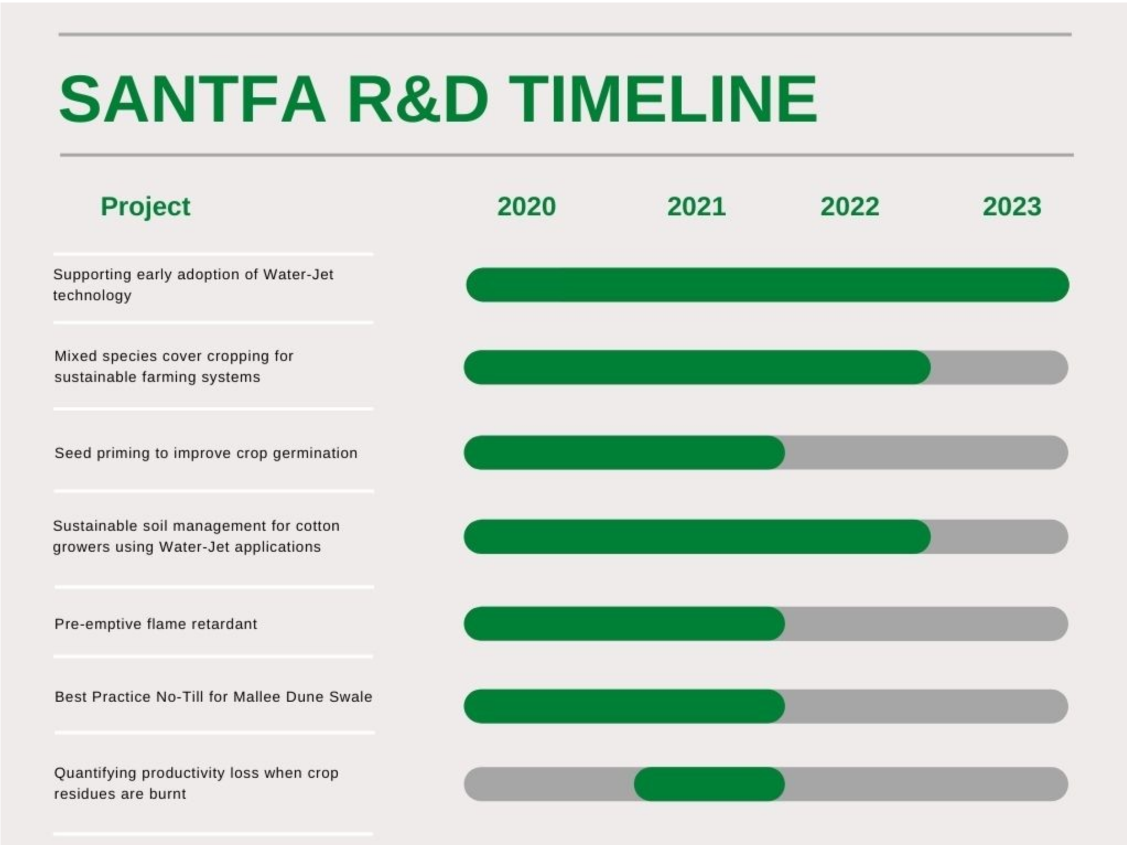


Virtual Fencing Trial

SANTFA R&D Update



SANTFA R&D continue to deliver a range fully funded innovative projects

SANTFA are looking to secure resources to further explore the following concepts

Sero-X

An innovative bio-active peptide known as Sero-X has been developed to control Heliothis and Diamond-Back Moth in northern Australian vegetable brassicas and cotton crops.

It is not a chemical insecticide and the Australian developed product is non-toxic to mammals and eco-friendly to beneficial pollinators such as bees.

SERO-X may have a good fit in southern Australia and SANTFA aims to test SERO-X in Canola at 3 sites during 2021.

Renewable Fertiliser

The ability to make nitrogen fertiliser from renewable energy has been demonstrated and international technology suppliers and fertiliser supply chains are currently developing pilot projects around the world; including in Australia.

SANTFA aims to develop a pathway where by farmers can be kept updated and subsequently engage the opportunities as they emerge.

Commercial Scale Biochar

The biochar trial results that SANTFA obtained 10 years ago showed promise however a major barrier to the adoption of biochar has been availability and price; due to low production volumes and high freight cost. Finally, a commercial scale biochar plant is proposed to come on stream in the South East of South Australia in January 2021. SANTFA is collaborating with the Limestone Coast Landscapes Board to develop a biochar demonstration program in cropping and livestock systems.

Virtual Fencing

SANTFA has applied to the latest round of the National Landcare Program to explore virtual fencing, and in particular, how virtual fencing can assist with on-farm carbon management.

Drought Hub

SANTFA is a member of the newly formed SA Drought Hub and more information will come through in due course.

5 Recent Insights into the Emerging Importance of Plant Root Exudates

Joel Williams | Integrated Soils

New thinking on root exudates

Recently I've been diving more and more deeply into the fascinating world of plant root exudates and I must admit I have become rather enamoured with this area of the plant sciences. In the same way that much of our understanding around soil microbiology is rapidly expanding with emerging analytical techniques, we are also gaining fascinating new insights into the dynamic nature of organic molecules that plants exude during their life cycles as well as their various functions in plant and soil interactions.

What makes this topic particularly interesting is the link between root exudates and soil biology. This interaction all happens in one of the hotspots of soil science investigation presently, in the rhizosphere. There is a wealth of research currently exploring root exudates, rhizosphere ecology and plant-microbe interactions; it's a bit of a can of worms, so much so, that I thought I would share a mini-summary of just five recent studies that were all published last year alone.

My top five studies here barely scratch the surface so another time I hope to write a more comprehensive overview on the fate and functions of root exudates more broadly, and I will certainly be elaborating and sharing these broader insights at the upcoming Vic No-Till conference on July 18 and 19 which is a good reason to book in now if you haven't already!

On that note, I'm very much looking forward to presenting and speaking with all those attending, but for now, I want to share something a little more on point – **5 fresh insights into the emerging importance of plant root exudates.**

Root exudates as regulators of the soil microbiome

We've all had a pretty clear idea that plants modify the soil microbiome in all sorts of various ways as they grow and develop during the growing season. This fact has often been exploited via the use of brassica green manures for biofumigation, high biomass grasses for organic matter accumulation, mineral accumulating plants to stimulate microbial liberation of locked up nutrients or more recently, diverse cover crop cocktails to support a spectrum of biologically driven agronomic and ecosystem services.

Many of the above benefits have already been linked specifically to the activity of root exudates of the plants, however, a recent study explored the direct link between specific root exudates and their ability to recruit specific microbial species with a feeding preference for those exudates[1].

We've had evidence of this for some time, for example, knowing that legumes release flavonoids to activate rhizobia or mycorrhizal associators exuding strigolactones to induce mycorrhizal colonisation. However, this study went a step further linking these exudate-microbial interactions with the genetics of the plant and the gene bank of the microbiome.

This then highlights that these exudate-microbial interactions can be pre-predicted and pre-programmed by the genetics and hence, manipulated for our benefit via plant breeding. With this extension of our understanding, it means we can begin specifically breeding new varieties to exude specific root exudates to induce specific microbes to perform beneficial functions for sustainable production systems.

We are all aware of the benefits of plant breeding generally but now being able to link plant breeding to soil microbiomes opens up a whole host of new possibilities in redesigning our production systems.

Maize that can fix its own atmospheric nitrogen?
A perfect practical example demonstrating the findings in the previous paper was the remarkable research out of USA/Mexico which uncovered a native landrace variety of maize cultivated for generations in a low nitrogen [N] soil by the indigenous peoples of Mexico[2].

This particular maize landrace is characterised by the development of aerial roots that secrete a carbohydrate-rich mucilage which was found to specifically recruit free living nitrogen fixing bacteria [Figure 1]. The roots essentially provided a home and specific food source for the bacteria to colonise and fix atmospheric nitrogen to the maize in exchange for carbon.

The researchers hypothesised that '*indigenous landraces of maize grown using traditional practices with little or no fertiliser might have evolved strategies to improve plant performance under low-nitrogen nutrient conditions'* and were they ever right. It turns out the maize was able to fix from 29-82% of its own nitrogen requirements.

The researchers took the variety to US soils and the maize was still able to perform this function, highlighting it was the plant genetics that were equally critical, not solely a specific N fixing bacteria unique to those low N soils in Mexico.

This paper highlights wonderfully the potential of linking plant breeding and soil microbiome research and offers a tantalising prospect of crossing this landrace maize with modern varieties of maize enabling them to fix a significant percentage of their own nitrogen and hence lowering our dependency on N from the bag.

This study highlights the importance of taking a systems approach to farm design – this variety will not function if grown in high N soils, we can't just plant the variety within our high input, intensive systems and expect it to fix its own N.

The use of the variety has to be coupled with a redesign of our production systems to support the plant genetics and N-fixing bacteria to fulfil this complete functionality – just imagine years from now having a variety of maize that could fix 80% of its own N requirements?

Figure 1: Aerial roots on maize excreting carbohydrate-rich mucilage containing specific exudates now known to recruit N fixing bacteria. Source: Van Deynze et al [2018].

Not just a sweet tooth after all

I'm sure you've all heard it a hundred times over, the classic line '*plants exude sugars to feed soil microbes*'. Of course, there is nothing wrong or false with this statement whatsoever but it is a gross simplification of the intricate nature and composition of plant root exudates[3].

Beyond sugars and carbohydrates which plants exude as raw food or energy for the soil food web, plants additionally release a whole cocktail of other compounds and chemicals which serve a multitude of different functions, some of which are outlined in Table 1[4].

Intertwined with this sugar-centred paradigm, it has long been assumed that sugars were the sole food source of mycorrhiza (as provided by plants) and that the fungus subsequently synthesised fatty acids from those plant derived sugars.

Advances in genetic analysis, however, revealed that the genes that encode lipid synthesis are absent in mycorrhiza so this is not actually possible. Researchers finally identified that not only do plants deliver sugars to mycorrhizal fungi but they additionally transfer lipids to the fungus also[5].

Evolutionarily speaking, it is thought that this is an energy saving adaption from the mycorrhizal fungi who can expend more energy on scavenging nutrients from the soil rather than waste energy on this lipid synthesis themselves. This study critically emphasises the importance of optimising plant nutrition being that essential minerals (such as sulphur in this example) are central co-factors in a host of enzymes which are the machinery of the cells and hence catalyse the biosynthesis of plant compounds such a lipids.

Exudates component	Functions	Specific compounds identified in root exudates
Organic acids	Nutrient source	Citric, glutaric, oxalic, malonic
	Chemoattractant signals to microbes	Malic, aldonic, fumaric, erythronic
	Chelators of poorly soluble mineral nutrients	Succinic, ferulic, acetic, butanoic
	Acidifiers of soil	Butyric, syringic, valeric, rosmarinic, lactic, glycolic
	Detoxifiers of Al	*trans*-cinnamic, piscidic, formic
	nod gene inducers	aconitic, pyruvic
		vanillic, tetronic
Amino acids	Nutrient source	a- and β-alanine proline
	Chelators of poorly soluble mineral nutrients	asparagine, valine, threonine, aspartate, tryptophan cystein,
	Chemoattractant signals to microbes	ornithine, cystine, histidine, glutamate, arginine, glycine,
		homoserine, isoleucine, phenylalanine, leucine, -Aminobutyric acid,
		lysine a-Aminoadipic acid, methionine, serine, homoserine
Sugars & Vitamin	Promoters of plant and microbial growth nutrient source	Glucose, desoxyribose, oligosaccharides galactose, biotin,
		maltose, thiamin, ribose, niacin, xylose, raffinose pantothenate,
		rhamnose, rhiboflavin, arabinose, fructose
Proteins and enzymes	Catalysts for P release from organic molecules	Acid/alkaline, phosphatase
	Biocatalysts for organic matter transformations	amylase, invertase, protéase
	Plante defence	PR proteins, lipases, β-1,3-glucanases
Purines	Nutrient source	Adénine, guanine, cytidine, uridine
Inorganic ions and gases	Chemoattractant signals to microbes	HCO_3^- OH^- H^+ CO_2 H_2
Phenolics	Nutrient source	Liquiritigenin, luteolin
	Chemoattractant signals to microbes	Daidzein, 4′,7-dihydroxyflavanone
	Microbial growth promoters	Genistein, 4′,7-dihydroxyflavone
	nod gene inducers and inhibitors in rhizobia	Coumetrol, 4,4′-dihydroxy-2′-methoxychalcone
	Resistance inducers against phytoalexins	Eriodictyol, 4′-7-dihydroxyflavone
	Chelators of poorly soluble mineral nutrients	3,5,7,3′-tetrahydroxy- 4′methoxyflavone
	Detoxifiers of Al	naringenin
	Phytoalexins against soil pathogens	isoliquiritigenin, 7,3′-dihydroxy-4′-methoxyflavone
		umbelliferone, (+)- and (−)- catechin
Root border cells	Produce signals that control mitosis	
	Produce signals controlling gene expression	
	Stimulate microbial growth	
	Release chemoattractant	
	Synthesize defense molecules for the rhizosphere	
	Act as decoys that keep root cap infection-free	
	Release mucilage and proteins	

Table 1: Potential functional role of root exudate components identified from different rhizospheres. Source: El Zahar Haichar et al [2014].

Building soil organic matter: plant residues or root exudates?

There is a great deal of new thinking emerging around the contentious nature of soil organic matter and I will be exploring this in depth at the upcoming Vic No-Till conference, but just as a teaser, this next paper is one of the most interesting as it challenges the dominant paradigm on how best to build soil organic carbon.

Although we can build organic carbon by simply 'applying it' in the form of composts, manures or other organic amendments, practically and economically speaking, in broadacre soils we are more reliant on incorporation and utilisation of crop resides as the primary source of carbon [C] that is integrated into soil carbon pools.

Certainly there is a firm body of evidence now highlighting the contribution of root litter as much more important than shoot litter in terms of building soil organic carbon [SOC][6–8], so straight off the bat we must shift our focus

to belowground C inputs and less so on aboveground.
But going a step further, this particular study investigated the contribution of plant litter vs root exudates and their results suggested that in fact root exudates have the potential to build soil carbon 2-13 times even more efficiently than plant residues[9].
This study certainly needs to be built upon and supported with more evidence from different environments and soil types, but it does point in a direction that suggests that perhaps maintaining living cover (and hence the flow of root exudates from living roots into the soil) may be even more important than stubble/residue management in terms of building soil carbon. This is not to say that stubbles do not still perform many other valuable functions which of course they do, something I certainly don't need to preach to Australian farmers.

Effects of grazing on root exudates

I thought I best include at least one piece of research for the readers who have livestock and this final study I'm sharing looked at the effects of grazed vs ungrazed pastures on root exudates as well as on C allocation to roots, microbial biomass and overall SOC levels[10].
They found that '*grazing exclusion was associated with dramatically less overall belowground allocation* (of carbon)*, with lower root biomass, fine root exudates*, *and microbial biomass'*.
Consequently, the enhanced C flow to the roots as found in the grazed pastures ultimately coincided with higher SOC overall, highlighting the beneficial effects of integrating grazing animals for building SOC.
In contrast to the previous study, this research identified that the more important contributor to building SOC levels in this instance, was not the root exudates, but the decay of the root biomass.
The enhanced root exudates and microbial turnover of that exudate carbon still made a valuable contribution to building soil carbon, but not as significant as the root litter decomposition. I should add that much of the evidence that supports the contribution of root exudates and subsequent microbial necromass (dead microbial bodies) in building soil carbon is linked to their ability to form minerally associated organic matter (organic matter that is attached to soil minerals and aggregates).
It should be noted this particular study was performed in Florida on highly sandy soils (97% sand), which have less clay and silt surfaces and these of course have greater potential to form this minerally-associated organic matter. Consequently, this may have been a factor in making the root litter more significant than the root exudates.
As mentioned previously, more studies are required to tease out this

nuance between root carbon vs root exudate carbon but either way, the evidence is clear that grazing supports more C flow to the roots and in one way or another this ultimately has the potential to sequester more carbon in soils.

In conclusion

Root exudates are so much more than just organic acids, sugars and carbohydrates and involve a complex and intricate suite of organic molecules exuded by plants. There is still much to learn about the dynamic nature of these exudates and how they influence a host of plant-microbe interactions. Nonetheless, it is clear there is great potential to make use of different plant species and the diverse spectrum of root exudates they each exude. A deeper understanding of these plant compounds and their potential to harness the soil microbiota holds great promise for future design of sustainable production systems.

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Hay in a CTF and No-Till System

By Melissa Pouliot

Scott Blurton

- Grey loam with sodic subsoil
- Continuous cropping since 2006
- Disc seeder since 2011
- Hay on CTF since 2013

When Streatham farmer Scott Blurton decided he wanted to increase hay production as a non-chemical alternative to weed control and added income stream in his no-till Controlled Traffic Farming system without compromising soil health, he had nobody to ask for advice except himself.
Five years later he feels he's now got the hang of it, and that he is definitely on the right track, literally.
Scott is an international pioneer of growing hay in a CTF, no-till system with many others around the world now looking to him for guidance and ideas.
"When I started looking into this there was nobody in the world doing it. It took a lot of thought, a bit of working out, but I wanted to produce more hay without going against the soil health benefits I was starting to see from my no-till, CTF system."
Having stopped burning his paddocks, getting out of sheep and implementing a no-till cropping system in 2006 to improve his soils and build a more robust cropping enterprise, Scott's initial motivation to produce more hay was to shift away from chemical weed control.
"We were struggling with rye grass which made it difficult to grow any legumes profitably, and we saw hay as a non-chemical alternative to weed control. It also got us away from relying so much on grain by providing a different income, therefore making the farm a bit more robust."
Because their rotation was heavily cereal-based they also had too much straw which was hard to manage, and hay became an important part of their rotation.

Summer covers

The real kicker though for taking his hay production to a new level by

converting it to no-till CTF was what he observed on his paddocks when he started growing summer covers. Through his involvement with VicNoTill, the concepts they were introducing to maintain all-year cover and grow different groups of crops for underground soil biology benefits had caught his interest.
"I started growing covers to get diversity and biology into the soil, plus extra cover on my paddocks. The summer covers wouldn't germinate on the tramlines but they had no trouble germinating in the paddocks. That set this up for me in my mind. We wanted and needed to keep producing hay for a whole range of reasons, so I had to find a way to do it without driving all over my soils."
He says most people told him it would be too hard, and he's not pretending that it hasn't been.
"It has taken a lot of working out and thought, and it been expensive to get into but now that I'm set up it's working really well."

Limited sun

Scott's family settled 'Tara' in 1947 in an often cold, wet and cloudy part of Victoria. Scott refers to his system as 'no-till cropping below the 45^{th} parallel' where you can go for up to two months in winter and not see the sun.
Although they get plenty of winter rainfall, their grey loam soils with sodic subsoil limits their ability to capitalise on the rain in spring. This year was a classic example, with a wet winter but the driest September and October on record. The result: a disappointing grain fill. But thanks to the hay being able to capitalise on the winter rainfall, the year has still turned out well.
"The hay has gotten us away from relying on grain because it gives us a different income and makes the farm more robust overall," he says.

Straw overload

Another reason for moving into the hay was trying to better manage their heavily cereal-based rotation.
"On a three-year rotation we are looking at 15 tonnes of straw per hectare in those three years. With this comes a lot of problems with establishing canola such as slugs, earwigs and all the other straw-related problems.
"The hay sets things up for canola seeding very nicely. It is an important management tool within our system from several perspectives."
Another key motivator for producing hay was to stop fighting so much with Mother Nature in the paddock.
"Essentially you can end up making money out of something you're spending big money on trying to control. I see it as more working with nature rather than against it."

Weed control

Scott says the proof is in the results.
"I've had a soil scientist come out and he said rye grass roots were good for building fine soil particles. That's where the hay is great because nobody wants rye grass in their crop because it's such a fierce competitor but you can make some money out of it in a hay crop.
"In terms of weed control, it has been really good. We were finding by the end of our rotation, by the time we got back to the canola, there was very high weed pressure and we were relying on chemicals to control the seed bank. Now that we have very low weed numbers out of the hay, it takes off the chemical pressure, and getting rid of that bulk our canola germination is better."

More robust

Scott says hay production is also a way for farmers to get all their eggs out of the one basket.
"I have definitely built a more robust system, now we're getting through the initial high purchase outlay, it's getting better all the time. I'm really happy with how it's working."
He's also happy with the amount of cover he still has on the ground.
"My soils aren't bare and exposed, there is still plenty of cover in my hay paddocks. I've got the rotary rake set up so we can hold the fingers up off the ground, and so we're keeping our cover.
"Also, by sticking to the tramlines, we're not compacting our soil and therefore not disturbing what we're trying to achieve in our no-till system."

Multi-species

He is also trying multi-species hay and has found that oats and clover go well together.
"The broad and narrow leaf go well together, we've just had to do some fine-tuning with the oat rate as they tend to choke out the clover. There are a lot of benefits to the multi-species such as a clean seed bed the following year, which sets us up for canola seeding very nicely.
"It also getting diversity into the soil which is good for our underground biology."

Disc benefits

Sowing with a disc means they have no clods, hence they have clean hay.
"The disc definitely helps from the perspective of no clods. In this environment we do have some challenges with the disc when it gets muddy and damp. When the disc is working well it does an amazing job."
Scott trialled a stripper front several years ago but felt it wasn't quite the right fit for his system.
"The stripper straw would provide too much shading, which I know sounds a bit strange when you speak to growers on the other side of the divide who are

wanting as much shading as they can. But you really need to experience our climate to understand it; we are more chasing the sunlight than trying to shade our crops from it."

Farmers helping farmers

Scott generous with sharing what he's learnt and is still learning. He says the value for him of being part of VicNoTill goes well beyond how to incorporate more diverse crops into your system and opening his eyes to CTF.

It's also the network of other growers to call upon and share ideas with.

Growers who have turned to Scott for advice include Luke Rethus, who farms near Horsham with his father Geoff and brother Tim.

Luke says the value of the VicNoTill network was invaluable when they wanted to set up for CTF hay. "You can ring someone up, have a chat about certain things, if I'm starting something new you can ring up someone and they're always happy to help. Like Scott with the hay."

Scott agrees. "It's good to bounce ideas with others and it's been good to see others making it work. I can learn from others too, like the Rethus's, and keep updated on how they're making it work in their system."

Long-term

The real motivator for what he's doing comes in the form of two little boys, Oscar 8 and Sam, 5.

"I've got two boys who are really interested in the farm and I'd like to hand it them in a better condition than what it is. And the way to do that is to keep improving my soils and farm in a way that is more in tune with nature and not against it."

Baling Hay on the Blurton's Property on CTF

Hay in a CTF system: how it works

12.19-metre (40-foot) tramlines

Scott says it was important to utilise their current equipment to keep costs down. They have set
up their system to use their John Deere 8320 for cutting, baling, seeding, chaser bin and spreader -
utilising it all year round.

Front mower and trailing mower on JD8320 tractor

"We couldn't find a butterfly mower that would fit into the 40-foot multiples so we improvised with a trailing and front mower. This leaves us with three swathes per 40-foot which makes the wind-rows not too big and gives us a nice even curing."

They rake the hay in front of the baler using a splitter (which they engineered themselves) on the front and a rotary rake to rake the three swathes into one central swathe in the middle of the tramline.

Using a Krone baler, a self-engineered bale deflector (shifter/slide) on the front of the tractor pushes the bales off the tramlines ready for pick-up.

"It took a good couple of weeks by the time we conceptualised the bale deflector and the splitter, modified them, tested them out in the paddock, then modified them a bit more."

Scott says the hardest thing to work out was how to then pick up the bales without going off the tramlines. There weren't any stackers available in Australia at the time so he found one on the web and imported a 12-bale Mil-Stak from the US.

"It took a lot to find that stacker. There is an Australian distributor now but at the time I had no option but to import one."

When they stack the bales, they make sure they go through all the way to the end and only turn on the headlands, as is standard procedure with their equipment in the CTF system.

Raking hay on 12m controlled traffic tracks

Four key points

1. It works really well on many levels but it's expensive to set up, so you've got to be doing it on a reasonable scale to justify that cost.
2. It's a way for farmers wanting a robust cropping system with covers, diversity and a soil health focus to get all their eggs out of the one basket.
3. You can adapt using your current machinery, but you will need to prepared to do a bit of your own engineering to make things fit.
4. Finding the right bale stacker can be a challenge, that was our biggest challenge.

Virtual Fencing Trial

Virtual Fencing for cattle is soon to become reality with the system in its final testing phase at present before its planned launch early next year. One such trial was held during October at Long Plains and it proved very successful. The trial used the virtual fencing system that will be available through Agersens as the ESHEPHERD platform with a focus on using spatial grazing for better weed and paddock management, the trial was funded by GRDC and CSIRO in partnership with Agersens.

The system uses a collar around the animals neck that gives an audio signal first and if needed a small electric shock signal when the animal gets close to the set boundary , once the animal is trained the audio is usually enough to stop the animal going any further. The system has been described as 'precision grazing' and will allow farmers to manage the grazing pressure to avoid under and over grazing as well as targeted grazing.

Cattle wearing ESHEPHERD collars enabling graziers to monitor animals and control movements remotely

When viewing the trial site there was a definite line in the pasture where the cattle would not push past and it showed up clearly on the fire break. When viewing the tracking data it was clear the cattle in the cell grazing area with the virtual fence were grazing the pasture and the weeds more evenly. The cattle in the open grazing walked the same lines more often and avoided some areas of the paddock meaning there was over and under grazing.

CSIRO researcher Rick Llewelyn's SANTFA Webinar presentation on the Virtual Fencing will be available on the Members Portal and he goes into detail of how the system works and where it will be of benefit. Sheep are the next part of the development and work on the sheep system prototype starts next year. SANTFA sees this technology as a valuable tool to help manage ground cover and stop wind and water erosion from over grazing but also as a tool to selectively graze weedy or frosted areas.

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