SEPTEMBER 2019 | VOLUME 16 | NUMBER 4 | SPRING

SANTFA
CONSERVATION AGRICULTURE IN ACTION

The Cutting Edge

CONSERVATION AGRICULTURE IN ACTION

Clear farming pros and cons for KI grower page 118

Sopping up Mallee soaks page 127

Tracking towards an autonomous future page 138

RE-DISCOVERING RHIZOCTONIA

RIGHT TIME FOR TRITICALE?

REASSURANCE AND CHALLENGE IN SURVEY RESULTS

STORAGE PART OF TRIPLE THREAT BUSINESS

SANTFA
CONSERVATION AGRICULTURE IN ACTION

Visit the website for the latest events and downloads

www.santfa.com.au

SPONSORS

SILVER

John Deere

BRONZE

Cropping Solutions
Manutec Grain Growers
Tillage Radish AV Weather
Viterra Glencore Grain
Needham Ag Technologies

SANTFA OFFICE

PO Box 930 Berri SA 5343
F: (08) 8125 6502
admin@santfa.com.au
www.santfa.com.au

SANTFA STAFF

Mandy Pearce
ADMINISTRATION OFFICER
PO Box 930 Berri SA 5343
M: 0418 805 670
F: (08) 8125 6502
admin@santfa.com.au

Greg Butler
RESEARCH & DEVELOPMENT MANAGER
PO Box 923 Clare SA 5453
M: 0427 424 278
F: (08) 8125 6502
greg@santfa.com.au

Leighton Pearce
COMMUNICATION & SPONSORSHIP
PO Box 930 Berri SA 5343
M: 0427 688 028
F: (08) 8125 6502
leighton@santfa.com.au

ISSN # 1839-7484

Design by Cultivate Design
www.cultivatedesign.com.au

SANTFA BOARD 2019-20

Callum March
PRESIDENT
PO Box 33 Balaklava SA 5461
P: (08) 886 21618
M: 0429 657 585
farm@richmondpark.com.au

Jason Berends
VICE PRESIDENT
PO Box 27 Yorketown SA 5576
P: 08 8852 1107
M: 0418 896 110
jasnjen@internode.on.net

Jamie Phillis
TREASURER
1419 East Dogfence Road
Ungarra SA 5607
P: (08) 8688 8047
M: 0427 476 362
jamiephillis75@gmail.com

Craig Woolford
PO Box 25 Wirrabara SA 5481
M: 0427 665 207
broadviewwb@westnet.com.au

Gareth Scholz
PO Box 93 Minnipa SA 5481
M: 0427 805 207
gareth_scholz@bigpond.com

Paul Roberts
PO Box 38 Karoonda SA 5307
M: 0419 869 285
paul_roberts125@hotmail.com

Contents

Cover photo: Bell family, Kangaroo Island.

CAAANZ
Ag Excellence Alliance

SANTFA is a member of Ag Excellence Alliance and Conservation Agriculture Alliance of Australia & New Zealand

President's Report

Rain events have been few and far between in the past couple of years, so the sight of full dams should be cause for celebration. Yet, as some in the Riverina will attest, it is merely a symptom of increasingly poor soils.

The south-western NSW region scored up to 75mm of rain in early April, but sadly for some farmers, most of it was lost due to severe runoff from bare ground and did little more than fill local dams. Farmers I have spoken with say the difference in water infiltration between farming systems has been stark and retaining some residue on soils has been key to preventing excessive runoff.

While most of us in SA have managed to avoid such extreme outcomes this year it is a reminder that the decisions we make one season will impact the next. Frost and drought have made grazing and cutting crops for hay an attractive option for many but some have also seen the re-emergence of soil erosion caused by wind; a problem we have not seen for many years and an issue no-till was thought to have solved.

We cannot ignore the link between high levels of crop residue and frost but neither should we forget the importance that stubbles play in protecting our soils from wind and water erosion and in aiding water infiltration and minimising evaporation. Loss of topsoil can be a long and expensive problem to fix.

At this time of year, keeping the bank manager happy is a high priority – and rightly so. I have wheat and barley coming down on my own property in a bid to take some of the sting out of this year's tough conditions. But let's not lose sight of what the long-term effects of our decisions will be and how quickly our land will recover when the rain eventually comes.

Callum March

Emphasising efficiency in the Mid North

KRISTIN MURDOCH

Efficiency and timeliness are critical elements of good farming management according to Leigh Fuller, who farms in the Mid North with his father Garry and uncle Craig.

The trio share roles on their 3,800ha of Mid-North holdings between Condowie and Gulnare, where the challenges they face include diverse soil types, undulating topography and working out how best to capitalise on the productive capacity of an area receiving around 400mm of rain a year.

"Craig manages the stock side while Dad and I share the role of managing the cropping," Leigh said.

"Currently the three of us are able to manage the workload throughout the year but we use casual staff during harvest. We accept that we will need other staff in the future but so far have been able to reduce the need for labour by investing in larger machinery. For example, we use an 18.2m seeder with a 20,000L air cart that is able to sow 80-100ha per fill.

THE FULLERS' 'RELATIVELY STABLE' CROPPING ROTATION, WHICH INCLUDES EARLY GRAZING OF BARLEY, IS ADJUSTED TO TAKE ACCOUNT OF WEEDS AND PRICE PROJECTIONS.

LEIGH FULLER SHARES MANAGEMENT OF THE FAMILY'S CROPPING PROGRAM WITH HIS FATHER.

"We place a large emphasis on efficiency as we believe timeliness is arguably the most important aspect of farming. Jobs need to be done on time, whether its spraying, harvesting or seeding, and it can be very costly if these tasks are done outside the optimum window."

Soil types on the Fullers' property range from heavy black cracking clays through red clays, loams and high-pH limestone ridges to areas of 'gutless' sand.

They have a diverse cropping program, growing Sceptre and Trojan wheat, Compass, Planet and Spartacus barley, Diamond canola, Samira and Bendoc beans and Jumbo 2 lentils plus Morava vetch on non-arable country for grazing.

"Our total cropping area is around 3,400ha of which 30% is sown to wheat, 30% to barley, 30% to legumes and 10% to canola," Leigh said. 'Our rotation is relatively stable but with subtle adjustments depending on weed management and commodity prices.

"We have massaged our rotation this year by replacing some of the planned canola and lentils with more cereal. We reduced our canola hectares because our subsoil moisture was low leading into seeding and our lentils in response to current deflated prices."

Their seeding rig is a Flexi-Coil 5500 hoe drill with tines on 254mm row spacing and fitted with double-chute Agmaster points and boots, a set-up they find gives consistent seed placement and good trash flow, with the row spacing helping the crops compete with weeds.

Ryegrass is their main weed and they have initiated an integrated control program incorporating herbicides, grazing, increased seeding rate and chaff lining at harvest with the aim of reducing its impact on their crops.

Thirty years ago the Fullers were running a self-replacing 1,500-ewe Merino flock but gradually reduced ewe numbers over the years as returns from wool decreased. Eventually they discontinued their breeding program and switched to buying in and selling sheep when conditions and prices are right. Consequently, the number of sheep on the property at any time now varies considerably depending on feed availability and current and forecast stock prices.

"We have chosen to no longer have a core breeding flock," said Leigh. "We wanted to reduce the labour component of running stock and turned to trading sheep rather than breeding them because trading requires less labour. It was a management decision that has worked well for us."

They have been focusing on trading instead of breeding for the past decade and generally handle about 10,000 head a year.

"We trade all types, from crossbred and Merino lambs to Merino ewes and older two to six-tooth wethers; anything we see that looks like an opportunity to make a dollar," Leigh said.

Before the downturn in live sheep exports the Fullers handled a lot of older wethers destined for the Middle East, a market they were well placed to service because of their proximity to SA's pastoral areas, which made it easy to source animals suitable for the live export trade, and to buyers' feedlots.

However, trading is not without its issues.

"It's been a challenge trying to source stock because the Australian sheep flock is at an all-time low due to drought conditions reducing lambing percentages and record prices having influenced people to sell more sheep for slaughter."

So too is the high cost of feed for the feedlot they were using to finish their stock for market.

Near-record grain prices in 2018 increased their feed costs and consequently reduced their margins, which has seen them move away from feedlotting in the short term. However, they see it as an opportunity and are happy to venture back into it when costs and conditions are right and the numbers stack up.

Sheep not in the feedlot graze vetch and native pastures on non-arable country and, early in the cereal growing season, are run into cropping paddocks to graze cereal crops, usually barley, that provide a valuable source of early feed because the vetch pastures typically take some time to get established before they are ready to be grazed. The cereals are grazed from early tillering to before stem elongation; usually about 25 days.

At this stage the Fullers have not measured the impact of grazing on the cereals but the subsequent appearance of the crops and the yields they produce suggest it has no negative effect on grain production, Leigh said.

They see Planet barley as a good fit for this graze and grain scenario because of its longer growing season and high biomass production. In a 'perfect scenario' they would plant Planet in late April when the soil temperature is still warm, graze it for three to four weeks then lock it up for grain production, Leigh said, and they plan to retain seed from this season's crop to use if there is an early opening rain in April next year.

With 'just about every soil type' on the Fuller farm the family uses a varied approach to soil management and find pH mapping a 'great, cost efficient tool'.

"We have found we have areas of low pH and to save costs have been pH mapping our soils with a Veris machine and using the results to target our lime application to areas where it will be most beneficial," Leigh said.

"In one 50ha paddock we limed recently we spread 70t of lime on 40% of the paddock where the mapping showed we needed to increase the pH. If we had applied the same rate across the whole paddock we would have used 175t of lime.

"We use gypsum, usually at 3-5t/ha, on our red clays that tend to be sodic in nature and have tried mapping and variable rate application of that using the EC reading on the Veris machine."

They are improving the performance of their 'gutless' sand soils, which have a low nutrient base by applying 7-10t/ha of biosolids and poultry litter to increase soil nutrient levels. Three years into a '5-10

LEIGH AND CASSIE'S SON LEWIS LOOKING VERY HAPPY IN A STRIKING CROP OF DIAMOND CANOLA.

year plan' they are noticing darker-green, healthier-looking vegetation and more biomass, with yield mapping showing a trend towards higher grain yields in treated areas.

They are also applying biosolids to improve the performance of crops on low-phosphorus grey clay soils.

"We try to treat 300-400ha a year with 3t/ha of biosolids, which provides roughly 30 units of phosphorus (P), but are maintaining synthetic fertiliser rates for early growth and to help build soil P levels," Leigh said.

"The aim is to treat each grey clay paddock once every three years and slowly build the P levels."

The biosolids, poultry litter, lime and gypsum are applied with a Bredal belt spreader that provides a 'good, even spread' of all the materials they put through it. The spreader is mounted on a MAN 4x4 truck, a set up Leigh finds efficient and relatively cost effective.

P applied to the Fullers' high-pH limestone paddocks is tied up in the soil by a chemical reaction that makes it unavailable to their crops and, with 'no real solution to unlock' this soil P, they previously saw little option but to apply more P fertiliser each year. Now however, with the ability to map soil pH, variable rate technology and access to biosolids, they are concentrating biosolid applications on higher-pH areas in the limestone paddocks to see if the organic matter in the biosolids will buffer the P they contain so it remains available to crops. If this proves to be the case biosolids could be a more cost-effective source of P than synthetic fertiliser in those conditions.

THE FULLERS ARE WELL EQUIPPED TO STORE GRAIN FOR THEIR STOCK OR MANAGE HARVEST PRESSURES AND TRANSPORT CROPS TO RECEIVAL DEPOTS.

Timeliness is arguably the most important aspect of farming.

"Currently we are variable rating our fertiliser at seeding time to try and achieve our best return on investment," Leigh said. "With our agronomist, Sam Trengrove, we have been using pH, NDVI and yield maps to create a P prescription for our cropping program."

Until recently they were applying 'replacement' rates of fertiliser calculated to replace the amount of P removed in the previous season's crops, but combining pH, NDVI and yield data enables them to identify areas that need more P than was removed in the previous crop. They have settled on rates of 20% more than the replacement rate where soil pH is higher than seven and 20% less than replacement where pH is below six.

Leigh, a passionate advocate for the role of farming systems groups and their link to growers, is an enthusiastic member of the Hart Field Site Group and has been a board member for the past four years.

The group, which was established in 1982 and operates a 40ha field trial site at Hart in the Mid North, is managed by farmers and industry professionals and hosts a popular annual Field Day each spring.

"Hart is a great organisation that provides independent and relevant information for local growers and consultants while also the agricultural industry Australia wide," Leigh said.

"As a committee member, it is great to give a little back to a group that has given so much."

While the family's Mid North base means they have not been directly impacted by urban growth and perspectives, Leigh is well aware of the issue and believes growers need to build and strengthen relationships 'with our city cousins' and address topical issues such as animal welfare and chemical use.

"If these areas are over-regulated it could cripple the farming community. As a community we need to advocate for best practice and help educate people about what we are striving to achieve."

No-till a no-brainer for mixed farmers

SARAH JOHNSON

Converting to a no-till system almost a decade ago has benefited the Loller family's livestock business as much as their cropping enterprise.

Balancing the competing demands of a mixed enterprise farm is never straightforward. Compromise is often the name of the game, with many growers juggling priorities and using workaround strategies.

For third-generation Mallee farmer Peter Loller, balancing the demands of cropping and livestock is one of his biggest challenges. "Having sheep and cropping is a constant battle," he said. "But I still think they complement each other."

Adoption of a no-till system almost 10 years ago was a turning point for the Loller family; the change delivering a series of flow-on benefits across the enterprise ranging from improved soil health to increased stocking rates.

The Loller's 3,400ha property, located 20km east of Karoonda, is run by Peter and his wife Hannah with the help of Peter's parents Don and Dorothy, full-time employee Dave Humphries and school-based apprentice Lawrence Somerscales, with school holiday assistance from their three children Max, Bridie and Patrick.

PETER LOLLER, WHO COMBINES SHEEP AND CROPPING ON HIS MALLEE PROPERTY, FOUND THAT A SWITCH TO NO-TILL CROPPING PRODUCED BENEFITS FOR HIS SHEEP AS WELL AS HIS CROPPING PROGRAM.

PETER LOLLER (CENTRE) RUNS THE FAMILY BUSINESS WITH HIS WIFE HANNAH (RIGHT) AND THEIR CHILDREN, MAX, BRIDIE AND PATRICK (PICTURED), PLUS HIS PARENTS DON AND DOROTHY, A FULL-TIME EMPLOYEE AND SCHOOL-BASED APPRENTICE.

Their transition to no-till began following the drought in the early 2000s, when soil erosion caused by a combination of overgrazing and conventional tillage emerged as a significant issue.

"In 2002 we had a lot of country that was pretty bare," said Peter. "Because we were working up the land we were very vulnerable to the wind. Looking over the fence to a neighbour's no-tilled property opened our eyes. They might have had a similar or slightly better crop than ours but the main difference was that their whole place held and ours didn't. It was about combatting wind erosion."

The Lollers began trialling no-till in 2004 and switched to a full no-till system in 2010 with the help of fellow Mallee farmer Allen Buckley, through a SANTFA mentorship program. Considered a pioneer of no-till in the region, Allen supported the Lollers in their move away from conventional cropping. "Allen's like the king of no-till in the Mallee and he saved us making a lot of mistakes," said Peter. "We talked to him before we did anything and while we had an agronomist who did a lot of the planning, Allen definitely helped us work out what to avoid and how to go about it.

"He actually came out here one day during seeding. To have someone take time away from their own seeding program to come and look at yours is pretty amazing."

One of the key strategies the Lollers used in changing to no-till was to use 15cm knife points instead of the more common 10cm points on their Horwood Bagshaw Scaribar to break through a compacted layer of soil. Minimal rocks on the property meant they were able to work to that depth without unearthing more issues.

Peter believes working deeper to break up the tillage hard pan contributed to the success of no-till on their property. "I had a plough go wayward in one of the droughts. It basically broke so a couple of tines dropped, and where the soil was ripped deeper there was a clear line where

a better crop grew. It was a 20cm strip right up and down the paddock that showed we had to get through the working hard pan, which at that stage was 7cm to 10cm down."

The Lollers are now experimenting with deep ripping to make further inroads into soil compaction, although a deep ripping trial conducted this year has generated mixed results due to poor subsoil moisture. "One thing we've learnt is that if you have no subsoil moisture in summertime it's not worth ripping because the first lot of rain just goes straight through," Peter said. "We actually got better germination on areas where we hadn't ripped, but that's just about learning. If we have subsoil moisture next year we'll take the trial further, but there are quite a few ripping trials in the Mallee this year so there'll be a fair bit of information going around."

After almost 10 years of no-till the Lollers are seeing improvements in their soils, with the benefits flowing into their sheep enterprise.

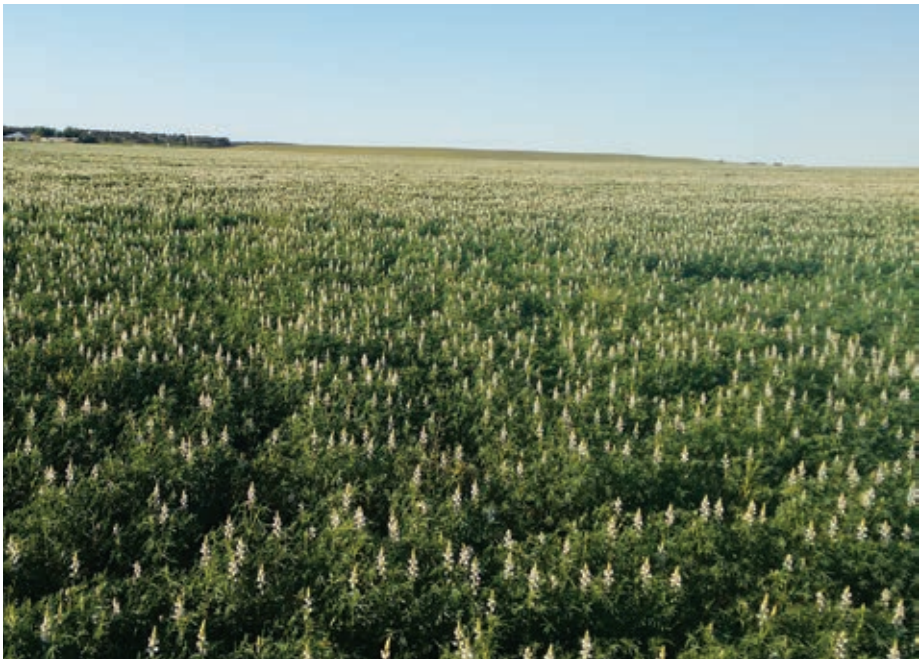
"No-till is a system, it's not a piece of machinery," said Peter. "The more you do it, the more you reaffirm it.

"Converting to no-till was initially about preventing wind erosion but we are seeing improvements to soil health and consequently to the quality of sheep feed."

They have also tightened their rotations.

"Since we've closed up rotations we've been able to grow a lot better sheep feed. By cropping more often there's more fertility in the soil which leads to more feed.

SULLA IN THIS TRIAL PLOT ON 'RELATIVELY DEEP SAND' PERFORMED BETTER THAN EXPECTED AND APPEARS TO PENETRATE HARD PANS BETTER THAN CANOLA OR LUPINS.



LUPINS ARE AN INTEGRAL PART OF THE LOLLERS' CROPPING PROGRAM.

"When I first came back to the farm we were running a one-year crop, two-year sheep system; basically a three-year rotation. From there we went to year-in, year-out or three years in and one year out, depending on how the paddocks performed, and started to crop the better ground more often.

"I noticed that our best stocking rates were on paddocks we'd cropped the year before, so we started cropping more and ran the same amount of sheep on less acres."

The Lollers also found that their livestock were emerging from summer in better condition due to stubble grazing and an increase to their fertiliser rates meant their whole system performed more efficiently. "Because we were cropping more often we put on more fertiliser and the system seems to work better. There's more soil biota and less root disease."

Today they generally crop 1,600ha of their 3,400ha property, although they reduced their program to 1,050ha this season due to a poor start. They have almost 200ha under permanent pasture and are currently running 1,400 breeding ewes and 650 ewe hoggets.

Managing stocking rates, stubble grazing and feed gaps are the main challenges they face in balancing the demands of the stock on their mixed enterprise farm. This year's reduced cropping program means there will be less stubble for grazing after harvest and Peter plans to move the sheep into containment lots to avoid overgrazing.

"We tend to move our sheep into containment lots very quickly; usually a lot earlier than most. We prefer having the option to let them out onto feed later rather than overgrazing first and being forced to put them in containment lots by lack of paddock feed."

He doesn't have a formal system for monitoring and moving his stock but works to a 100-day rainfall system he learnt through Rural Directions on a feed tour. "I don't have a spreadsheet to consciously monitor it, but in my head I'm always thinking about how much rain we have had over the past 100 days. If that starts to drop away then I'm already thinking about getting rid of something or containment lotting. In my head I'm three or four weeks ahead of what's about to happen."

Peter also aims to shift sheep from paddock to paddock periodically to prevent them establishing 'camps' and degrading those areas. He learnt from a trial conducted at Lameroo that sheep left in a paddock for a month tend to establish camps on the top of sand hills, and that rotating mobs between paddocks as often as every week can help avoid that and reduce their impact on the environment.

Managing feed gaps for stock has also changed on the Lollers' property since they converted to no-till.

"I think sheep and cropping complement each other but we're reducing our grass weeds to benefit our cropping program,

which is impacting the amount of grazing we are getting from our cropping paddocks, so our feed gaps have changed. We're starting to think about putting some rye in early on one part of the property to make sure we've got early feed and focussing on predominantly medic pasture in other paddocks. That's just part of the crop/livestock juggle."

Alternative pasture species are another option, with insights to what might work in their conditions and farming system one of the positive by-products of hosting a Mallee Sustainable Farming (MSF) trial site on their property since 2009. Two forage legumes that look promising include arrowleaf clover and sulla.

The Lollers planted arrowleaf clover in 2017 and 2018, using it for grazing and harvesting seed for future plantings. "Even though it was a drought last year we had subsoil moisture, so we grew great amounts of arrowleaf clover and the lambs went really well on it in our system," said Peter. "And it stands up enough that you can harvest it."

At this stage they have sown only 20ha paddock of sulla, but are optimistic about its ability to break through hard pans. "Even though it's not supposed to be suitable for lower rainfall areas the sulla grew some amazing amounts of biomass on our trial site, which is on relatively deep sand. It's gone a lot better on the trial site than it has in the paddock but we're finding that it gets its tap root well past hard pans we can't get canola, lupins or anything else to penetrate. We're hoping we can open up some soils with it."

Finding a crop to cover the property's sand dunes and provide supplementary forage is another focus for the Lollers.

VELDT GRASS HAS PERFORMED WELL IN TRIALS ON PETER'S PROPERTY, PRODUCING GOOD BIOMASS IN TIME FOR LAMBING IN JUNE AND JULY, AND HE IS PLANNING TO ESTABLISH A MIX OF VELDT AND ARROWLEAF CLOVER ON HIS SANDHILL PADDOCKS.

MSF trialled tedera as a forage option but Peter says veldt grass has shown the most potential. "Tedera didn't really fire up, so we've planted a few high sand dune paddocks with veldt grass and have found we can get a lot more biomass out of that. And it tends to get established before winter grasses start in autumn so we can lamb onto it in June or July, if it's spelled well enough over summer."

The Lollers' property is fenced according to soil type; a strategy established by Don and Dorothy when they managed the business. This approach means they have six 40ha sand dune paddocks on which they plan to establish a mix of veldt grass and arrowleaf clover.

The family grow wheat, barley and lupins that all yield an average of about 1.5t/ha. Subsoil moisture is the main limiting factor on their cropping program and was an issue last year when they received only one 6mm rainfall event in 150 days.

THE MSF TRIAL SITE HARVESTER IS DWARFED BY A COMMERCIAL HEADERS ON THE LOLLERS' PROPERTY.

Their participation in MSF trials means they have had access to the Yield Prophet computer model that generates simulations of potential crop yield with different levels of inputs and they have used the results of simulations using conditions on their property to improve their decision-making around fertiliser applications. "You can put in an amount of nitrogen and the available subsoil moisture at different times of the year and at different depths and the program helps you work out the happy medium for nitrogen," said Peter. "It helps me make informed rather than gut decisions."

Most of their fertiliser is applied up-front, with supplementary spreading in some seasons. They have experimented with variable rate (VR) nitrogen applications based on manual calculations but are not equipped for full VR application at this stage. "The MSF trials showed us that up-front nitrogen applications provide the best bang for our buck, but efficiency is also important. If seeding's going to take two weeks longer because of the time it takes to fill up the seeder box more often then you've got to take that into consideration. You can't compromise other things like germination and frost windows."

Next on the Lollers' agenda is getting a neighbouring property they recently bought up to 'no-till' speed. The 890ha property is conveniently located across the road from their existing farm, making the purchase a 'natural progression' for the family. "We have things working well here and know what it will take to get the other property up and going and working in our system without too many surprises."

Clear farming pros and cons for KI grower

KATHERINE MAITLAND

Producers on Kangaroo Island have very clear benefits and challenges, according to fifth-generation grower Travis Bell.

Travis, with his brother Lachlan, farms at Cygnet River, west of Kingscote, where the average rainfall is a relatively reliable 450mm a year.

The Bells farm 3,500 hectares on which they grow wheat, canola, faba beans and malting barley and run 13,000 Merino sheep.

Their country is variable in soil type, with everything from non-wetting and deep porous sand to stone over clay and heavy Bay of Biscay clay.

"Our growing season is usually from April to October," Travis said. "Our cropping program is wheat, malt barley, canola and faba beans. We grew broad beans for a number of years up until last year but we were struggling to get them to yield well due to moisture stress in dry springs so we have switched to faba beans, which handle drier conditions a bit better.

"We continuously crop and have trialled cover cropping.

"We also do contract spraying, spreading, seeding and harvesting for other producers on the Island."

Two thirds of the Bells' land, some of which is not suitable for cropping, is used for livestock, mainly Merino sheep for wool with some prime lambs out of older ewes. Travis runs a vertically integrated system, with some of the grain grown on the property used to feed livestock, including feedlotting prime lambs when conditions and prices are right.

"Livestock makes up two thirds of our business."

Travis describes Kangaroo Island is a good place to farm because rainfall is usually reliable and it is rare to have frosts because of the moderating effect of the surrounding water.

"We get a good amount of rainfall that is normally spread over the season, although if we get a large amount of rain in June, July or August it often results in water logging. The past few seasons have been better years and we have been lucky.

TRAVIS BELL WITH WIFE INGRID, AND CHILDREN MIKAYLA AND ZANDER IN A CROP OF CANOLA, A MAJOR CROP FOR THEM.

"We generally sow dry and don't wait for rain. In recent years we have sown canola and cereals the first week of April. The only crops we hold back to wait for moisture are the legumes.

> **The past few seasons have been better years and we have been lucky.**

"We played around a little with cover crops to add diversity into our system a few years ago but in the three years we tried them we had no summer rainfall so they didn't even germinate. However that was unusual, so we might try a multiple-species crop again this year," he said.

The family business has undergone major change in the past three years, with Travis and Lachlan taking on the management responsibilities from their parents, Rodney and Judy. The transition was managed through a formal succession planning process initiated five years ago and undertaken in conjunction with their Adelaide-based accountant.

Steps in the process included establishing a board with an independent chairman, a change Travis said has proved to be of significant value for the succession exercise and overall management of the business.

The management transition has been accompanied by progressive changes to the farm designed to improve efficiency without increasing costs.

"I was frustrated that we were not getting the yields I felt we were capable of in this environment with our rainfall," Travis said. "We are in a relatively high rainfall

area of 450mm yet were achieving yields of only 1.7 t/ha for canola, and 3.5t/ha for wheat, while other parts of the State with less rainfall were producing higher yields.

"I went to a local conference where I heard Wayne Smith speak about what our potential was in this environment and he suggested we should be able to consistently achieve 8-10t/ha in wheat, 3-5t/ha in canola and produce pastures capable of carrying 40 ewes plus their lambs per hectare. Afterwards I bailed him up and asked if he would run some trials to show us how to reach the numbers he was suggesting."

Four years on, Travis and his family are close to gaining the results they were aiming for without doing anything 'out of the ordinary'.

"We didn't do anything particularly fancy," Travis said. "Wayne was able to help us identify what our limitations were and helped us overcome them to improve our performance. He also helped us fine tune other things we were doing okay but needed to do better.

"There is plenty of information out there about things we knew to be right or of benefit but for whatever reason we were only doing a couple of them like stubble retention and trying to implement controlled traffic.

"The real benefit comes from doing everything you know has a positive effect on production together but we were overlooking some of the basics. For instance, we knew we had acidic soils but we hadn't been addressing that. And we knew trace elements were important but we hadn't been putting out anywhere near the rates of them needed to enable our crops and pastures to produce to their potential. We now have a seeding bar fitted with liquid injection technology we use to inject the right amount of trace elements up front.

"Along the way we found that our sandy soils were lacking potassium, which we had never previously identified as an issue, but applying sulphur provided the most significant yield increases."

"Given our rainfall we were quite conscious of nitrogen leaching out of our soils but we were overlooking that sulphur leaches just as readily," Travis said.

"At least 25% of yield potential is lost by the time you see visual symptoms of a nutrient deficiency and with a yield potential of 8-10t/ha a drop of 25% or more is a big hit, so we are taking a proactive stance to nutrition by identifying which areas are lacking what each year and rectifying potential deficiencies early in the season so crops have no nutritional limitations."

He is also taking a preventative approach to weed control by spraying weeds early, whilst they are at the one to two leaf stage.

"We were finding ryegrass difficult to manage but worked out that was because we were leaving it too long and often not spraying until after two or three germinations, so the oldest plants were quite large. Now we are hitting weeds when they are younger and smaller."

And the results are starting to show.

"For the past three years we have consistently produced an average of more than 5t/ha of wheat and 3t/ha of canola.

GM-FREE STATUS A PLUS FOR KI, SAYS SHANE

Kangaroo Island grain and other products are recognised world-wide for their quality and cleanliness.

And with the Island to remain free of genetically-modified (GM) crops that can now be grown in the rest of SA, grain growers on the Island look set to maintain that reputation into the foreseeable future.

Shane Mills, CEO of Kangaroo Island Pure Grain (KIPG), the Island's grain marketing co-operative, describes Kangaroo Island as 'unique'.

"Our growers are producing grain on an island with an international reputation for being clean and green. Reliable rainfall means droughts are rare on the Island and we are in a strong marketing position, especially with the announcement that Kangaroo Island is to remain free of GM crops," said Shane.

"This year, farmers on the Island are growing non-GM canola, Westminster and Planet malting barley, soft wheats including Impala, Trojan and other milling wheat varieties, and broad beans. There are also small areas of faba beans and lupins.

"Grain from KI is sold to domestic flour millers, breweries and stockfeed manufacturers and exported to Japan and South East Asian countries, often at premium prices.

"The decision to maintain the moratorium on GM varieties on Kangaroo Island is recognition of the value of the markets we have been able to establish for non-GM canola.

"These markets, particularly in Japan, have provided our growers with a premium over domestic prices for the past 10 years, so being able to continue to service these markets is extremely positive for us."

Farmers on Kangaroo Island, which also has aquaculture and tourism industries and a significant number of non-farm residents, feel they have a responsibility to respect the natural environment and ecosystems and employ agricultural best practice where possible, Shane said.

"Growers have been farming on KI for years and are well aware of the environmental significance of the Island and their footprint on local flora and fauna."

He sees the Island's location, rather than the land or natural environment, as the biggest challenge for KI producers, with freight costs the big issue.

"The cost of freight to deliver grain from the Island to port or a domestic market reduces returns and the cost of freighting inputs such as fertiliser and chemicals to the Island increases production costs, so it impacts at both ends of the production chain."

Cropping on the Island is also facing competition from other farming enterprises.

"The strong prices for prime lambs means cropping land on the Island is under significant pressure and it is only the resilience and commitment of our growers to grain production that is enabling us to continue," Shane said.

I am still on the journey but I have seen a massive improvement in our overall efficiency and crop nutrition," he said. "As we improve we are seeing larger areas consistently producing more than 7t/ha of wheat and 4t/ha of canola."

Travis says the costs and isolation of living on Kangaroo Island are at least partly balanced out by marketing benefits.

"One of the best things about farming on the Island is the location. Many say that because we are on an island we have higher freight costs and logistics, but from a marketing perspective being on KI means we can capitalise on the clean environment because we have a clearly defined coastline boundary and are well recognised world wide for our natural clean green image.

"On the other hand there are logistical challenges that mean we need to plan and order ahead so we have inputs on hand when we need them. We can't order something today and expect it tomorrow."

The Bells employ three local workers.

"My father still works on farm and we employ three full-time farm hands," Travis said. "Sourcing labour can be challenging on Kangaroo Island but we are lucky to have a good team. Last time we needed a worker someone came knocking on our door, so I think it's about finding the right person and looking after them. It's often not the job that makes people leave but circumstances, such as a partner wanting to move back to the mainland."

SPRAYING EARLY IS HELPING TRAVIS, WHO FARMS AT CYGNET RIVER ON KANGAROO ISLAND, GAIN BETTER CONTROL OF HIS WEED POPULATIONS.

Most of the Bells' grain is handled by KIPG, with the balance sold locally or used on farm in their livestock enterprise.

"Selling grain through KIPG is good risk management option for our business because it ends up in a pool that usually returns good prices with premiums. And KIPG market over a 12-month period so sales are spread over market peaks and troughs.

"With demand for stockfeed growing on the back of high lamb and wool prices, local graziers are coming to us to set up contracts that we aim to structure with minimum and maximum price limits linked to the market price at the time the grain is delivered; a win-win approach we believe works for both parties."

TRAVIS, HERE SOWING CORN INTO A SPRAYED-OUT STAND OF BROAD BEANS, HAS A DIVERSE CROPPING ROTATION AND AIMS TO KEEP COVER ON HIS SOILS WHENEVER POSSIBLE.

Travis is happy to grow non-GM crops as long as they continue to command a premium that more than offsets any agronomic or yield penalty from not having access to varieties with GM traits capable of boosting efficiency or yield.

"The market we have in Japan offers a healthy premium for non-GM canola and the freight is completely subsided, so it's a good outcome for us. However, we would have no issue with changing to GM if the marketing benefit disappeared."

The Bells sell malting barley to Coopers brewery through KIPG, when the quality is right.

"We have started to grow malting barley for Coopers, who have indicated they are prepared to work with us on a year to year basis. We don't always nail the specs. Last year our barley had fractionally higher than ideal protein levels, but they still took it. They are there to build a relationship."

The future for grain growers on Kangaroo Island could depend on their ability to improve their total production, either by increasing yields or the area cropped, or both, he said.

"We need to achieve high yields and keep improving what we are doing, which does not necessarily mean spending more money, but being smarter about the way we farm and the timing of our management practices.

"The challenge is to produce enough tonnes to meet market demands and keep KIPG storage costs down, which is a struggle when livestock prices are so high."

Reassurance and challenge in survey results

GRAEME JENNINGS

Members have given the SANTFA board a clear message – stay focussed.

This 'take-home message' from the just-completed survey of members is at once reassuring and challenging.

Re-assuring in that it points to general satisfaction with what the association has been offering in recent years; challenging in that maintaining what on the surface presents as the status quo, albeit with some tweaks or refinements, will not be easy in a changing farming and communication environment.

There is also an element of reassurance in the profile of membership duration, with just more than 54% of respondents having been members of SANTFA for more than 10 years and 43% of respondents new members in the past decade.

A total of 94 members responded to the survey, which is a 26% response rate – excellent for such surveys – so there can be no doubt about the validity of the findings, although comments on some of the more specific questions reveal a diverse range of interests and opinions.

Drought rated well down the 'interest' rankings.

The survey revealed majority support [52%] for an annual conference, though a significant minority [28%] would like to see a biennial conference, possibly with local 'mini conferences' in alternate years, and considerable support [32%] for collaboration with other farming system groups.

Respondent comments about conference topics reveal considerable diversity of interest, including some dissatisfaction with repeat messaging from overseas speakers on subjects such as 'cover cropping', there were significant commonalities: a desire for local input and for speakers sealing with 'blue-sky'/cutting edge topics, food nutritional value, rather than yield, integrated pest management and beneficial insects and the production benefits of native vegetation.

At the other end of the scale, 22% of respondents indicated they did not attend last year's conference because they considered the topics and themes to be irrelevant to them.

However, the fact that 67% of respondents rated soil health as their top 'industry-related topic' suggests the board is 'on the money' so far as the base issue is concerned, even if there are reservations about the detail and similarity of content of some of the presentations by US speakers at recent SANTFA conferences.

Weed control [12%] was the only topic other than soil health to receive a double-figure 'top priority' rating, with 62% of respondents rating weed control at their top, second, third or fourth priority.

67% of respondents rated soil health as their top 'industry-related topic'.

Machinery was rated at second, third or fourth by 55% of respondents, with finances rated third, fourth or fifth by 40%, although 28% rated finances at eight and nine in their 'interest' rankings. Similarly, drought rated well down the 'interest' rankings, with 62% of respondents ranking drought at six to nine.

Respondents identified the overall association as 'farmer driven and independent' and differentiated from other farming system groups by its research and innovation strategies. They value the association for its independence and initiative, for the fact that it is State-wide, for keeping abreast of new technology and its willingness to consider accommodate 'left-field ideas' and 'think ahead of the current system'.

It is clear from the comments, as well as the 'standardised' formal responses, that SANTFA's most valued attributes include its independence and innovative approach, its focus on providing reliable, unbiased information and its willingness to challenge conventional, often commercially-driven thinking, address alternatives and actively tackle emerging issues.

On the other side of the coin there is significant dissatisfaction with the recent focus on summer cropping and cover crops and several respondents pointed out that, with no-till now the norm, there was a perceived lack of direction and a consequent need to 'move to more innovative or out-there ideas' to regain momentum.

Work on the new plan, which will re-focus and provide new direction for SANTFA is well advanced.

President Callum March said the SANTFA board was pleased with the response and had drawn on the feedback in its development of a new strategic plan for the organisation.

Work on the new plan, which will re-focus and provide new direction for the association, is well advanced, with a draft expected to be available before Christmas.

It was heartening to be reassured that SANTFA continues to be respected and valued within the farming industry, Callum said, and members should be proud of the organisation's good standing across the sector.

"Our independence gives us the ability focus on issues important to our members.

"We assume everyone knows who SANTFA is and what we stand for but some of the responses suggest that is not the case for everyone. There appears to be a need for us to get out and explain our current ideas and exciting research initiatives to growers and others who thought SANTFA's role finished with the wide-spread adoption of no-till.

"The SANTFA board has always been willing to look outside the box and explore innovative options, whether considering R&D initiatives or conference topics or speakers.

"Some of the survey responses made it clear we don't always hit the mark but we always aim to bring value to our members and are open to ideas, feedback or comment at any time, not just through surveys."

Boosting landscape function for profit and planet

SARAH JOHNSON

Regenerative farmer Bruce Maynard is on a mission to ensure the future of agriculture and the communities that make it tick.

Farming must be about working with nature, not against it, says Bruce Maynard, one of Australia's leaders in regenerative agriculture.

He believes this philosophy, which he's worked hard to nurture on his family's property in central NSW, is critical for agriculture's sustainability and the health of the planet.

"Twenty or so years ago, climate models were anticipating what we're experiencing now, but in 2050 or 2100. We're getting there early," said Bruce, who is experiencing the harsh realities of climate change like so many NSW growers.

"It's pretty nasty around our way. We've had just four growth events over the past three years. Our rainfall pattern as it's travelling now is more like Alice Springs. Our stocking rate is only a fifteenth of what it was prior to the millennium drought and we're scratching our heads wondering whether it should be zero. Like many places in Australia I've travelled to lately, we've got some decisions to make. The continent is in pain, landscape-wise and community-wise."

REGENERATIVE FARMER BRUCE MAYNARD.

BRUCE MAYNARD IS WORKING TOWARDS 'TRIPLE LAYER' COVER – GRASSES, SHRUBS AND TREES – ACROSS HIS PROPERTY.

The fourth-generation mixed enterprise producer, who farms at Willydah, near Narromine, has dedicated much of his 35-year career to developing a farming system that maintains as much landscape function as possible.

His environmental awareness led the Maynard family to become early adopters of holistic management and cell grazing and to embrace diversity across their property. It also gave rise to Bruce's development of No-Kill cropping, a system in which crops are sown into natural grasslands that has helped enable the family to reduce input costs and boost their land's carrying capacity by increasing biomass.

Bruce's appetite for innovation in agriculture and his respect for environment was sparked by a one-year Rotary exchange to the United States where, as a senior high school student, he witnessed the full gamut of farming extremes including growers going broke despite rich glacial soil, price subsidies and government support for those buying land for cash.

The lesson he took from his US observations was that systems are key.

He subsequently came to believe that incremental improvements to existing systems would not drive the change that agriculture, farming communities and the climate needed. Rather, success in agriculture would rely on creating systems that capitalise on the resources available.

"The exchange program was a good experience for a young man and made me think hard about how things operate," he said. "It had to be about a constant search for systemic change rather than a change in tactics.

"When I came home it was straight into the frying pan. We had started to run into the first precursors of the major climate shifts allied with high interest rates and expansion. We had to work hard for quite a period of time amending what we were doing with our existing systems but the thought never left me that if we just kept on trying to improve existing systems we were going to continue driving the existing trends in a similar fashion.

"So I always tried to think hard about breaking away from those systems. If

I didn't want the results we were achieving I had to think about a change in direction."

That change came in the 1990s in the form of a holistic approach to agriculture that treated cropping and grazing as one entity and actively considered the impact of farming enterprises on the ecology. It was a move away from a simplification model in which monocultures ruled to diversification fostered through time-controlled grazing management and No-Kill cropping.

The starting point was a long-term whole-farm plan, produced in conjunction with the then NSW Soil Conservation Service, that set out objectives for the next 100 years of farming at Willydah and helped the Maynards focus on the future sustainability of their property.

"The reactive annual stuff is necessary but you have to always keep stepping forward to the next point," said Bruce. "Long-term planning was one of the planks in the early '90s. We were one of the first people in our part of the world to implement cell grazing and holistic management and that changed things dramatically for us because it started to create a huge amount of diversity that wasn't there before with our traditional grazing and management system. That was a precursor to a cropping system that boosted diversity rather than simplified the ecosystem."

We are going to have to do a hell of a lot more in ag with a hell of a lot less.

Bruce developed No-Kill cropping, which involves disc sowing dry into natural grasslands and eliminates the need for pesticides, herbicides and fertiliser, in 1996.

The family had been direct drilling their crops since the mid-1980s but began to question the wisdom of removing the biological diversity and biomass being built up through cell grazing and other management initiatives to accommodate their cropping program.

"We'd been direct drilling for a decade but having to remove all that diversity each time we wanted to sow a crop was a bitter pill to swallow," said Bruce.

"We realised we were at a big fork in the road. Either we keep on increasing diversity with our grazing then taking it back to zero with our cropping or we think about doing cropping differently. We chose the latter."

CHECKING THE LATE-SEASON BIOMASS OF A 2006 NO-KILL CEREAL CROP SOWN INTO ESTABLISHED PERENNIAL GRASSES.

He describes the change to No-Kill cropping, which saw him sell his direct drill bar and sow 80ha dry using a double disc unit fitted to his old seed delivery equipment, as a 'burning bridges behind me exercise'. The rest of the cropping program was sown after the season break with the same equipment.

"That was the beginning of things because the crop sown dry literally doubled the wet-sown stuff," said Bruce. "It was the tipping point of the whole systemic approach, because any system that relies on moisture sowing must do something about weeds and that's the crux. If we're doing anything about weeds it falls to either tillage or chemicals, both of which are causing difficulties on a grand scale across the continent and around the world."

No-Kill cropping is based on five main principles: sowing dry, using straight-running, coulter-type seeding equipment, no pesticides or herbicides, no fertilisers and good grazing management. Eliminating chemical and fertiliser inputs reduced the Maynards' cropping input costs to one tenth of what they were previously, but there is a casualty.

"Croppers will ask the question, quite rightly, what about the yield?" said Bruce. "Grain yield with No-Kill is about one quarter to one third of what you might expect from a monoculture crop but here's a really important point: total biomass increases by 30 to 40%. That's a real distinction, but a hard one for people to get their heads around, because when you're doing conventional cropping it's about grain production.

"In monoculture cropping you obliterate everything else and you've only got one product coming off the paddock. But with No-Kill you have the potential of multiple products at 10% of the regular cropping cost. It becomes your choice

ELLA MAYNARD IN A NO-KILL CROP OF CEREAL RYE GROWN IN 2009, DURING THE MILLENNIUM DROUGHT.

what you do with the crop, whether you harvest it for grain, get the four-footed headers to harvest it for you, make silage or use it as hay.

"There's also a synergy with livestock, because No-Kill changes the whole feed base. It's not just about the extra dry matter; there's also dietary diversity.

"When you sow a cereal or other grain crop into mixed grassland you place a high-nutrient, low-toxin plant in amongst many other plants, some of which are high-toxin, low-nutrient, so you give the animals the ability to utilise the whole smorgasbord in front of them, which addresses all the long-term weed issues.

"Weed populations dwindle because the animals keep on consuming plants they wouldn't otherwise eat. Using No-Kill on an area gives the stock a much greater ability to take on a swathe of plants that were formerly weeds and start to utilise them."

No-Kill cropping is part of a holistic approach to agriculture that enables the Maynards to maintain a grassland layer in the landscape. Bruce has evolved a strategy that incorporates three layers of vegetation, including shrubs and trees. He believes each component benefits the environment and his farming operation in a different way but all contribute to landscape function. In simple terms, when the landscape functions at an optimal level it can make use of all of the resources available to it as they arrive, including moisture, sunlight and the soil's nutrients and biological activity.

When they began holistic farming the Maynards' farm was missing a shrub layer because the plants had either been removed to make way for cropping or grazed by livestock, so in 1998 Bruce began experimenting with planting saltbush in various layouts as a means of re-establishing shrubs in the landscape. This proved to be an evolving process in which he started with blocks of saltbush then transitioned to alleys before eventually adopting curved plantings.

"In some ways it was a matter of how long does it take you to get to the bleeding obvious," Bruce joked of his experimentation.

He found block plantings, which involved mass planting saltbush in close proximity, simplified the grassland layer too much. Alley plantings, widely spaced rows of saltbush with room between the rows for cropping and grazing, provided shelter for livestock and protected crops from wind damage, resulting in a significant lift in production. Curved plantings achieved with spiral plantings, the configuration he has now settled on, provide protection from the wind for stock and crops at any time of the day. "My land is very flat, so it doesn't have natural contours, but going on the contour is the way to go."

The family established more than 300,000 saltbush plants on less than 15% of their property and these plantings, despite the relatively small area, improved livestock carrying capacity and profitability, a clear sign of how much extra biomass the shrubs provided, said Bruce.

CATTLE GRAZING NO-KILL MILLET, WITH THE COMBINE BRUCE USES TO SOW HIS NO-KILL CROPS IN THE BACKGROUND.

LIAM MAYNARD WITH HANDFULS OF CEREAL PLANTS FROM A COMBINATION NO-KILL STAND OF OATS AND BARLEY SOWN IN 2014.

However, a fungal disease that hit saltbush plantings across eastern Australia in 2013 killed 80% of the original saltbush plants on the Maynards' property and they are now looking for alternative shrub species to replace saltbush as a source of livestock forage.

"Saltbush provided the biggest boost to our farm for 20-odd years but I couldn't recommend it as a production plant now.

"The disease seems to be endemic now and the production characteristics of infected saltbush probably aren't strong enough to warrant its use. It will survive but would have only wind reduction value."

The family is experimenting with about 10 different shrub species that might replace saltbush as a forage. These include a cactus known as Spineless Prickly Pear but Bruce is unable to confirm its suitability at this stage. "We won't stop with our work to find multiple answers. We're never after a silver bullet; we're after silver buckshot," he said.

Bruce sees adding shrubs and trees as a way of making better use of the available land and believes all farmers, whether they run stock or not, can benefit from establishing grass, shrub and tree layers within a landscape.

"Think about adding componentry on

top of what you're doing to enhance your existing product. Even if you never utilise the shrubs for forage, there are wind protection and long-term nutrient recycling benefits. Plants with roots that extend deep into the soil profile bring materials up to the surface that wouldn't otherwise be available to shallow-rooted plants. The same applies to trees. It's thinking about what we can put on top of places in ways that suit the individual and the business. That's the starting point.

"If someone is really focused on their cropping income we'd be thinking about doing designs with trees and shrubs on the edges of their paddocks that will give them an increase in crop production while adding elements that bring more diversity and other community benefits along for the ride."

However, species, site location and planting layout must be carefully considered before establishing plantings of shrubs and trees, he cautions.

"Shelter belts can be highly effective but there are plenty of examples of completely ineffective belts that make evaporation rates worse. If someone just dives in and gives it a go without a lot of good information it's very easy to do a poor job of it."

But he has no doubt that finding ways to introduce more diversity to the landscape is crucial for the future profitability of agriculture.

HARVEST TIME AT WILLYDAH. NOTE THE FULL COVER OF GRASS UNDER THE NO-KILL CEREAL CROP BEING HARVESTED FOR GRAIN.

"In the long run we can't have simplistic systems without the expectation of an ever-increasing need for outside inputs. Simplification has served us well as a species for ten thousand years but we now have a problem with scale.

"We've gone everywhere on the planet and we keep on simplifying the last bits and there's a price to pay for that. Whenever we take out bits of landscape function we're going to have to pay to replace that function one way or another. We need to find creative ways of getting the function back that don't affect people's bottom line in the short or longer term.

"If you want to reduce your outside fertiliser use or herbicide use you've got to increase the soil biological activity and start recycling some of the stuff you've paid good money for.

"There's a squeeze point coming to us all fast, whether we're interested in the landscape or not. We are going to have to do a hell of a lot more in ag with a hell of a lot less.

"And that's not about energy, because humans are being very creative about finding new ways to energise. It's some of the non-renewable things, such as phosphorous.

"How can we liberate more phosphorous? The general statistic is that three quarters of the phosphorus applied as fertiliser gets locked up in the soil, so for a cropping regime, let's think about ways of getting that back by mobilising it. And how do we mobilise it? With biology. And that depends on how much soil function we can reinstitute."

But, he acknowledges, adapting existing farming systems to regain landscape function is no simple matter.

"It's not just about saying, 'here do A, B and C.' It's a big mindset change and you have to assist people with that. The information is not enough, nor is desire. They also need support."

To that end, he is involved in the Constructive Farming Cooperative, which has developed the Grassland Grain System, a three-year structured program that assists farmers with achieving high incomes from nutrient-complex grains.

Bruce advocates that farming businesses be scaled to involve more participants, not less, and points to landscape enhancement as a means of helping resolve key issues around finite resources and diminishing farming communities faced by the agricultural industry around the world.

He sees buying more land as an example of scaling outwards that often leads to smaller farming communities.

"For a stronger industry we need more participants joining rather than a steadily declining number."

"Intensifying production by adding a pig or poultry enterprise or transforming the goods produced is one way to help achieve this but is not for most people," he said. "That's about increasing the intensity of activity and that's fine, but it requires a huge number of extra skills and risk."

Re-discovering rhizoctonia

KATHERINE MAITLAND

Rhizoctonia root disease is attracting renewed attention, after several decades out of the spotlight.

South Australian Research and Development Institute (SARDI) soil biology and molecular diagnostics leader Dr Alan McKay says rhizoctonia has impacted many cereal crops in low to medium rainfall districts this season.

"The dry spring in 2018 followed by a dry summer favoured greater production and survival of rhizoctonia inoculum on cereals and grassy pastures than normal and set up 2019 to be a bad year for rhizoctonia root rot," he said.

"The familiar bare patches caused by rhizoctonia infecting seminal roots of seedlings were common in many cereal crops sown relatively late in 2019."

Rhizoctonia has also affected early-sown crops, but because infection occurred around mid-July, when soil temperatures dropped to 10°C, these early crops were damaged at mid to late tillering instead of at the seedling stage so they did not develop bare patches, Dr McKay said.

The lack of bare patches in early crops led many growers to think they had avoided rhizoctonia but that was not the case.

"Rhizoctonia may cause bare patches in early-sown crops if it attacks early seminal roots but primary root growth can also be restricted by a range of other constraints including compaction layers, herbicide residues, low moisture, low soil temperatures and nutrient deficiencies, so bare patches are generally not the most common rhizoctonia symptom in early-sown crops."

Research funded by GRDC and SAGIT over the past 10 years has shown that rhizoctonia is still present in most areas with a history of the fungus. However, crops are generally being sown earlier than they were years ago when the disease emerged as an issue, so they are more advanced when rhizoctonia infects the roots.

"When crops are sown early in paddocks infected with rhizoctonia they usually grow well until mid-July, then canopy growth can become uneven, especially in barley. This uneven growth, which can be subtle and hard to detect, especially in wheat, is caused by loss of crown roots that results in fewer and shorter tillers on infected plants. The key message is that crop top growth is not a good indicator of root health.

"By late winter or early spring, short spear tips near the crown are often all that remain of the crown roots, and if spring rainfall is low, the fungus may grow down the soil profile to infect seminal roots. This can lead to crops with good above-ground biomass but disturbingly little root system to support grain fill."

This can significantly reduce crop yield if conditions during flowering and grain fill are less than ideal.

"Mild temperatures and plenty of available soil moisture can make up for a compromised root system during grain fill," he said. "Even crops with very poor root systems can finish reasonably well provided growing conditions are favourable.

"However, if spring conditions are less favourable, with hot conditions and little soil water, high-biomass crops with poor root systems are likely to suffer significant yield penalties. Furthermore, if spring rainfall is below average, rhizoctonia will continue to develop on the root systems until the crop matures and produce high levels of inoculum to infect the next crop."

It is important to know which crops are infected so plans can be implemented to reduce the risk to the following crop, Dr McKay said, and the GRDC has commissioned SARDI to deliver six grower workshops in collaboration with regional grower groups in SA and Victoria to showcase rhizoctonia symptoms in early-sown crops and discuss management options.

Dr McKay began working on management of soil-borne diseases more than 30 years ago and soon discovered that monitoring pest and pathogen levels in soil was a major bottleneck for research and a challenge for growers wanting to monitor the effects of different management practices on root diseases.

"My interest in rhizoctonia began in the late 1990s when we started evaluating DNA tests to monitor inoculum levels. This progressed to working with David Roget and Gupta Vadakattu (CSIRO), and later Daniel Huberli (DPIRD) to develop management strategies."

SARDI SOIL BIOLOGY AND MOLECULAR DIAGNOSTICS LEADER DR ALAN MCKAY IN THE FIELD.

His work on using DNA as a diagnostic tool led to development of PredictaB, a DNA-based soil test that measures the amount of pathogen DNA, including rhizoctonia, present in soil samples.

"We don't have a magic bullet for rhizoctonia but there are a number of practices that, when combined, provide a level of control of the disease," he said.

"Rhizoctonia does have some weaknesses. To start with, it is not very competitive in warm moist soils over summer, provided summer weeds are controlled. Also, grass-free oilseed, pulse and pasture legume stands are poor hosts for rhizoctonia. The fungus can cause patches in these crops and spear tipping on their roots, but post-harvest soil inoculum levels are relatively low following them.

"Sowing early is also important in helping minimise the impact of the disease. Apart from setting the crop up for high yield potential, early sowing enables the seminal root system to develop while soil temperatures are warm and roots grow quickly.

"Rhizoctonia does not seem to infect rapidly growing plant roots, so removing constraints to rapid root growth by measures such as addressing nutrient deficiencies and disturbing about 50mm of soil below the seed can also improve crop performance where rhizoctonia is an issue, as can appropriate use of fungicides."

Protecting the crown roots in early-sown crops is more challenging than protecting seedling root growth, Dr McKay said, so it is important to monitor what is happening in the crop by digging up plants between mid-July and early spring and washing out and examining the crown roots for spear tipping. If this reveals significant loss of crown roots and a tight finish is expected it might be advisable to consider cutting the crop for hay.

"Liquid streaming fungicide above the seed at sowing is currently the only treatment to provide useful protection of crown roots," he said. "Only roots in soil the chemical has reached are protected and fungicide applied in this way has four to six weeks to disperse in the soil before crown roots develop. The best liquid streaming results achieved in proof of concept experiments were obtained when fungicide was applied above and below the seed to try to protect the crown and seminal roots."

THIS IMAGE, OF A CEREAL ROOT SYSTEM ATTACKED BY RHIZOCTONIA, CLEARLY SHOWS HOW THE DISEASE IMPACTS CROP PERFORMANCE WHEN THE AVAILABLE MOISTURE IS AT DEPTH IN THE SOIL.

Senior research officer Blake Gontar, who has recently joined Dr McKay's team at the Waite Plant Research Centre after working as a Research Agronomist with SARDI on Lower Eyre Peninsula, is working on a GRDC-supported project on management of soil-borne diseases.

"I started working on rhizoctonia a couple of years ago, looking at how addressing deficiencies of nutrients such as phosphorous, copper and potassium can influence crop disease and am now involved in several projects including one to develop a way of improving the reliability of results from trials of measures to control soil diseases including rhizoctonia," Blake said.

This methodology is currently being evaluated in SAGIT trials to determine whether current barley cultivars such as Compass and Spartacus have different tolerance to rhizoctonia and next year we plan to study interactions between rhizoctonia and other soil-borne pathogens including Pratylenchus neglectus and crown rot."

Significant gains have been made in management of rhizoctonia but he believes more can be done.

"Some observations suggest in-crop N application can improve growth of rhizoctonia-affected crops but we are not sure how this relates to the amount of root damage or whether the return on investment is worthwhile.

"We're currently working on strategies that combine modern agronomic tools to stimulate and protect crown roots and supply the crop with the nutrition it needs.

"Previous work has shown liquid streaming of fungicides can be effective, however this is expensive and a bit complicated and growers have been slow to take it up. More work is required on ways to optimise liquid streaming or develop new application techniques and to improve grower confidence in the technology."

Other management strategies are also on the agenda. While no sources of resistance to rhizoctonia have been found in cereals, crops do vary in tolerance to the disease, with yield losses greater in barley than in wheat, and varietal differences are suspected but not confirmed.

The current focus on soil improvement or amelioration may also have implications for management of the disease.

"We need to examine the effects on rhizoctonia of measures such as clay delving and spreading and organic amendment undertaken to improve water use efficiency," Blake said. "Do any of these provide long-term control or does the fungus re-establish after a few years? Perhaps changing soil condition in this way could promote the development of disease-suppressive soil.

"The golden aim is to have soils which buffer against rhizoctonia. Dr Gupta Vadakattu, from CSIRO, has done a lot of work in this area and found that suppression can develop in grower paddocks where conservation farming practices are used and stubbles are retained, but it's not all clear sailing and takes a long time.

"At the moment, I am concerned about the prospects for next year.

"The combination of more paddocks sown to cereals in 2019, due to a tough 2018 growing season, combined with the forecast for low spring rainfall, means inoculum levels will be increasing. Unless we get substantial summer rain, rhizoctonia will be worse next year, so good summer weed control and early sowing next year will be important.

"Where rhizoctonia is an issue growers should also consider growing wheat instead of barley where possible in 2020, increase seeding rates to compensate for loss of tillers and ensure adequate nutrition at seeding to encourage vigorous early root growth. And if the break is early, consider grass-free break crops or pastures to reduce inoculum for 2021 crops.

"In medium-high rainfall areas with good yield potential, growers with a liquid system could consider streaming fungicide above and below the seed to protect crown and seminal roots.

"The key message going into 2020 is to know your disease burden. Keep in mind that above-ground crop growth is not a good indicator of root health, so it might be worth taking a closer look at root health and root disease while the crop is still green.

"If you are unsure about root disease levels in a paddock after the crop has matured, a PredictaB soil test is the best way to assess the disease burden in the coming year."

Tracking towards an autonomous future

KRISTIN MURDOCH

The only way to keep up with the increased Asian demand for food is to maximise outputs and adopt new technologies, according to WA grower Boyd Carter, who is looking to introduce autonomous technologies into his farm management practices.

Boyd, with his father Keith, manages 'Glenfyne', a 12,000ha property at Jibberding, 18km east of Wubin and 48km from Dalwalinu, in the central wheat belt region of WA, near where the rabbit proof fence meets the Great Northern Highway.

Their annual average rainfall is 280mm, 180mm of which falls in the growing season.

The Carters began farming in the Jibberding district in the 1920s and Boyd, who joined the business when he was 18, is the fourth generation involved in its management. They employ one permanent and two casual staff and contractors are brought in for grain carting at harvest and as needed for lime spreading and spraying or fertiliser spreading outside of what the family can handle themselves.

The Carters' farming system includes a pasture phase that, with saline valley floors that have been sown with saltbush for stock feed, supports an opportunistic stock program of 2,500 to 3,000 Merino and crossbred sheep.

BOYD CARTER AND FELLOW NUFFIELD SCHOLAR DYLAN HIRSCH ARE DWARFED BY THIS AUTONOMOUS VEHICLE, TECHNICALLY A DOT 'IMPLEMENT CARRIER' DESIGNED TO BE FITTED WITH 'TOOLS' TO UNDERTAKE DIFFERENT FARMING TASKS, THEY ENCOUNTERED IN SASKATCHEWAN, CANADA, DURING THEIR NUFFIELD STUDY TOURS.

They sow aim to sow 9,700ha of mainly wheat, lupins, barley and canola each year.

"We make crop rotation decisions on a paddock by paddock basis," Boyd said. "Soil types, pH, past history and problematic weeds are all guides in our decision making process."

BOYD AT HOME IN WA CHECKING HIS MACHINE AND THE JOB IT IS DOING INCORPORATING LIME APPLIED TO COUNTER SOIL ACIDITY.

Their sowing rigs are two 60ft DBS bars behind JD tracked tractors and at harvest time they run two headers.

They operate a full controlled traffic (CTF) that confines their machinery to permanent wheel tracks – tramlines in local WA parlance – so their cropping soils are not compacted by the vehicles.

Last season the Carters planted 1,620 ha of canola (Banito, Stingray, 44Y89), 2,896ha of barley (Scope, Litmus, Spartacus) and 4,832ha of wheat (Chief, Corack, Emu Rock, Mace, Sceptre, Zen). They have red clay soils and acid sands and use a different rotation on each: pasture/barley/barley/wheat/wheat/pasture on the red clays and pasture/lupins or canola/wheat followed by wheat or acid-tolerant barley on their sandy soils.

"We have a range of soil types across the property," Boyd said. "About 60% of our land is good yellow sand over gravel. We also have Wodjil, which is acidic yellow sand, red clay flats and sandplains. High aluminium levels are an issue in the Wodjils and we have low carbon levels on the

sands and gravel."

WA sand-plain soils are typically affected by constraints including water repellence, sub-soil acidity, sub-soil compaction and poor water and nutrient holding capacity. Soil amelioration options to address these issues and improve soil structure and health and crop performance include strategic application of soil amendments such as lime, dolomite or gypsum, the use of deep tillage or a combination of an amendment and tillage.

Many of these constraints are issues on Glenfyne but the Carters don't apply organic matter or clay because they have no non-wetting soils and don't use organic amendments because the economics of this approach don't 'stack up' for them, Boyd said.

They do however apply lime to their paddocks to combat soil acidity, a practice they began about 35 years ago, and the soil in each paddock is tested at least once every three years.

"Liming is critical," Boyd said. "We put lime test strips on our red clay soils and can still see these 20 years later because they have different weeds and more clover.

They look to maintain a pH level of 4.8 to 5.0 in their sandplain country and apply lime to 30% of their cropping area each year. Their standard application rate is 1t/ha but some of their leased land receives more because it has not been limed for as long as their owned property and so is more acid.

The lime is incorporated to depth, sometimes with a deep ripper and sometimes with a disc plough.

"The true benefits came when we started discing in the lime," Boyd said.

"For the past 12 years we have been deep discing to 350mm to create a larger bucket of healthier topsoil, which with the liming, has helped raise our wheat yields on the Wodjil soils from 0.8t/ha to 2.4t/ha in similar rainfall years. Liming also results in better weed kill because herbicides work more efficiently on healthy weeds. Generally we find weeds are easier to kill on country that has a higher pH because we regularly add lime."

The Carters also deep rip paddocks every six to eight years, a process they began in 1996. Paddocks to be ripped are limed ahead of the ripping so the soil disturbance takes the lime into the soil. In years when a paddock is limed but not ripped a disc plough is used to incorporate the lime.

They currently run two rippers; a Westland machine with tines on 380mm spacing that rips to a depth of 300mm and a Primary Sales bar with 460mm tine spacing that is capable of ripping to 400mm. The Primary Sales machine has been modified so the tines can be lifted to avoid damaging the CTF tramlines.

"The aim is to get the lime as deep into the profile as quickly as we can.

"We hope to be able to stop ripping so deeply once we have succeeded in raising the pH of the subsoil. At this stage, our 30 years of liming has seen the sandplains receive 10t/ha and the pH level is now around 4.8 to a depth of 400 mm."

In addition to the CTF, the farming system on Glenfyne incorporates use of auto steer machinery, variable rate technology, on-farm grain storage, no-till seeding, 'double knock' pre-seeding herbicides and WeedSeeker technology to minimise the risk of herbicide-resistant weeds. The WeedSeeker, which uses imaging technology to target summer weeds, has also improved the efficiency of the Carters' summer herbicide program.

They are also using a variety of harvest-time weed seed destruction methods as part of their weed management program: windrow burning in wheat and barley and a chaff cart in lupins. Canola residue is returned to the paddock as feed for the sheep.

"At the end of the day it's the weed burden that helps us decide whether to use the chaff cart or windrow burn," Boyd said. "Sheep are a great economical weed management tool for us. If grasses, particularly ryegrass and brome grass, make a paddock unmanageable we remove it from the crop rotation and put the sheep in. They have the potential to save us a lot of money on herbicides. We also target these grasses and wild radish by spray topping when the paddocks are in pasture."

Boyd, who graduated from the Australian Grain Farm Leader's Program (AGFLP) in 2016, is enthusiastic about innovation in agriculture and interested in understanding how farmers make decisions about their businesses. While in the AGFLP he developed a decision-making matrix he has subsequently shared with growers across his region and beyond.

His involvement in the AGFLP broadened and improved his industry knowledge, helped refine his leadership abilities and taught him skills that are proving beneficial in his role in the family business, Boyd said.

The program also improved his understanding and management of the farming systems and technologies being

BOYD [LEFT] WITH ANDREW BATE, PRINCIPAL OF SWARMFARM ROBOTICS, AND A SWARMFARM IMPLEMENT CARRIER.

used on Glenfyne, provided opportunities to investigate the use of information technology in other sectors, such as mining, and linked him with a group of forward-thinking farmers who are continuing to share their learnings from the program and their subsequent experience.

"The skills I learnt are also leading to better management on our farm in regards to our employees, which means long-term dad and I can spend time away from the farm looking at ways to increase productivity without having a negative impact in the short-term," he said.

"As a broad acre farmer in the wheat belt of WA in a 280mm rainfall area, efficiency has always been important to our business and the development in technology has allowed us to double our arable hectares with very little extra labour. Staffing is not an issue for us at this stage but that may change in the future."

Boyd is a member of The Liebe Group, a grower-driven, not for profit organisation that provides information to more than 100 farming businesses in the Dalwallinu, Coorow, Perenjori and Wongan-Ballidu shires.

The group supported his participation in the 2014 Innovation Generation event – a conference for 'young agricultural enthusiasts' – where he saw a presentation by Andrew Bates of SwarmFarm Robotics that started him thinking about how driverless machines would affect the business and social aspects of broad acre farming areas.

"Andrew spoke about small un-manned machines doing tasks currently done using big machines. I said to my fellow Liebe Group Members 'this will be the next big thing in agriculture'. This eye-opening concept began churning away in the back of my mind and all the positives began to take shape. It would eliminate the compaction issue, it would mean being able to pay workers more because they are not doing mundane tasks and jobs such as looking after fire breaks could be done all year round instead of being squeezed into a month or two.

"However, I also began to see the negatives of a driverless future; not so much for the business but the community. Being in a community that has lost two schools and seen golf, bowling, cricket and football club memberships fall, the loss of more people from the community would be a real threat. I'm happy to say the local community population is currently growing."

In 2018 Boyd was granted a Nuffield Scholarship to study the 'robotic revolution', with a focus on driverless vehicles and how to help farmers prepare for autonomous technology.

"I felt that if farmers could feel more comfortable with the idea of driverless machines the community would be early adopters, leading to more people in the area because of the need to establish a supply chain for the robotics," he said.

He is studying the adoption of autonomous technology in broad acre farming and plans to write a 'how-to' manual to help farmers prepare for and incorporate this technology into their farm management practices.

On his scholarship study tour to Canada, North America, China, Denmark, Germany and the Netherlands he visited farms, machinery companies and machinery hubs where he saw low and high-tech approaches from home-made tractors to the latest in digital technologies.

"Driverless systems can not only save time. They can also enable savings on maintenance, fuel and labour," he said. "The machinery can operate 24 hours a day and be run at a slower speed, enabling more accurate chemical application." However, there are still issues to be resolved. "Access to technical support and GPS dropout are a couple of issues that need to be addressed."

Boyd aims to apply his research findings on the family property but says the business is not yet to the stage of actually running robotic machines.

"I wanted to research this topic because I could see a social impact. Where I live is quite isolated and we suffer from reduced community numbers all the time. I also have an issue with paying workers to be steering wheel attendants. Don't get me wrong, I understand the benefit of a good operator, but I'd rather have them doing more important work. And with the reduced number of people coming to work in agriculture I can also see an issue with getting employees in the future.

"I can see machines without drivers making it easier to get things done in a timely manner. For example, we could use autonomous machines to get summer spraying done while the main crew is harvesting.

"However, I don't think driverless machines will replace our existing equipment at this point. Perhaps they will in the years to come.

"At this stage I am looking at retrofitting a low-powered tractor with driverless technology or something similar to do jobs it would be used for with a driver.

"I will go into driverless machines but am still waiting on the right platform and supply chain. I think each business has to assess the advantages and uses of this technology for itself and see it as likely to be of great benefit in intensive enterprises such as horticulture.

"The issue where I farm is that there is no local technology supply chain."

Right time for triticale?

SARAH JOHNSON

Triticale lost favour with many Australian growers almost a decade ago, but its ability to produce biomass and grain in tough conditions could see it re-emerge as a viable option for dryland farmers.

Triticale grain production was dealt a major blow when Viterra stopped accepting the crop in 2010.

Growers with storage facilities and easy access to feed mills and other markets continue to include it in their rotation, but long-time triticale breeder and advocate Dr Kath Cooper says it's now somewhat of an underground operation, although mainstream seed companies do have triticale seed available and GRDC fact sheets on its attributes and how to grow it are readily available.

"Some farmers will say, 'I'm going to keep growing triticale because I've got markets, but I don't like telling anyone about them as I don't want to compete with anyone else and lose that market', so it's a bit of a secret industry," she said. "But many people who buy seed from us say they can't produce enough triticale grain or forage to meet the demand."

A triticale enthusiast for more than 35 years, Kath and her partner Mike Elleway own a 515ha farm at Sherlock in the SA Mallee. The property, on which they produce certified seed for sale to growers throughout Australia, is also home to a triticale breeding facility, a self-funded research operation in which Kath is continuing to develop new varieties.

From 1982 to 2004 she worked as a researcher in the University of Adelaide's crop breeding program, undertaking triticale breeding and associated research to support development of markets for the grain.

She met Mike, a Cowell farmer who had seen the resilience of triticale first-hand, at a recreational cycling event.

"Mike says there were seasons on his family's farm when triticale was the only crop worth harvesting," she said. "He wanted to help progress triticale because it had helped his family. He assisted me with trials and promotion of triticale on Eyre Peninsula, got a research position at the University of Adelaide and eventually worked with me on the triticale program. We would both like to see the crop stick around and progress."

KATH COOPER CHECKING THE PERFORMANCE OF TRITICALE LINES AND VARIETIES IN HER TRIAL PLOTS ON THE SHERLOCK PROPERTY SHE RUNS WITH PARTNER MIKE ELLEWAY.

Despite what she perceives as a lack of industry support for triticale, Kath believes triticale's resilience in drought conditions could see renewed interest in 'this currently undervalued crop'.

"If the season is tough, triticale will still produce something," said Kath, who grew a triticale crop at Sherlock last year on 154mm of growing season rainfall. "We had hardly any subsoil moisture because that was the second year of drought. It was amazing." A 5mm rain event at heading provided enough moisture to fill grain on the thin triticale crop but all their legume crops failed. "We got absolutely not a single grain off any legume, but that was partly due to frost too."

Kath and Mike recently had a NSW grower looking for crops able to handle the drought conditions in his district drive across from Forbes to enquire about triticale. "He said, 'we can't grow canola and have thousands of hectares of wheat dying around us, so we want to go back to trit'."

Triticale, developed by crossing wheat and rye, will thrive in high-moisture conditions but has several characteristics that make it a good fit for drought-prone regions, Kath said. These include tolerance and resistance to root disease, the ability to grow and produce a saleable crop on relatively poor soil conditions and potential for erosion control.

"It's got a deep, aggressive root system that holds the soil together and prevents erosion, so it definitely reduces the amount of dust blowing, which we've seen too much of during the past couple of years," said Kath. Its extensive and vigorous root system also delivers good disease tolerance because any root pruning due to disease is offset by the number of healthy roots. Some varieties have an absolute resistance to cereal cyst nematode (CCN), which can be beneficial for following crops in the rotation where CCN is an issue. "You can clean up CCN by growing a triticale variety that hosts zero cysts for two successive seasons ," she said.

There are also ongoing soil health benefits

to be gained from triticale recycling nutrients from sub-soil layers and later providing a source of organic matter for soil biota. "The big root systems can get down to deep soil moisture, which we've certainly seen in our sandy conditions," said Kath. "It must also access nutrients from deeper down and then, when the crop's finished, the roots are left in the soil for the soil biology to live on. We believe we have improved the productivity of our poor soil with repeated seasons of triticale growing.

"Another interesting triticale characteristic is that it alters the pH in the soil around its roots. It's tolerant of acid and alkaline soil and can amend the root zone pH to make better use of trace elements and phosphorus. That has to make the soil better for subsequent crops."

She knows of NSW growers who favour triticale for its ability to amend or tolerate low soil pH, which means they can avoid the cost of liming.

It can be grown with low nutrient inputs, making it an option for lower-yielding areas – "many growers tell us triticale is their best-returning crop when considering how much cost and effort they put into it" – and, with triticale showing tolerance to Russian Wheat Aphid and providing strong competition to weeds, growers are also likely to save on herbicides and pesticides, she said.

"An influx of Russian Wheat Aphid at Sherlock in the past few years has severely reduced our wheat yields but had no obvious impact on our triticale yields."

Triticale grain has a variety of uses including baking and craft brewing but its ability to produce large amounts of biomass is currently a major selling point, with most of the seed Kath and Mike sell bought by mixed enterprise farmers growing the cereal for forage crops.

WHEN CONDITIONS ARE RIGHT TRITICALE CAN PRODUCE A LOT OF BIOMASS, AS EVIDENCED BY THIS 2016 CROP BEING CUT FOR HAY ON KATH AND MIKE'S PROPERTY IN THE SA MALLEE.

"Triticale is a good producer of high quality, highly palatable forage if you grow and conserve it properly," said Kath. "It recovers well after grazing and produces more biomass than many other cereal and legume varieties, particularly in drought conditions. The interest in growing triticale for forage has definitely increased in the past decade."

This trend may continue with her development of Wonambi, a long-season variety being marketed by Naracoorte Seeds.

"We wanted someone else to market Wonambi as it's really too long-season for our low-rainfall farm, although it hurries up if it has to. It seems to produce lovely dense grain and achieve yields similar to anything else in a short, dry season."

Naracoorte Seeds were very happy with how Wonambi performed in their trials last year, when it tillered well after heavy grazing, and have included it again this year, she said. "We'll see how it goes this wetter, cooler winter."

Kath selected Wonambi for its high test weight and vitreous smooth grain but it is also suitable for forage, with long stems and reduced awns making it palatable for livestock.

Rufus, a variety bred with the support of two universities and GRDC research funds prior to 2004, was Kath's first forage triticale release and remains her best seller for the stockfeed market. "Rufus really advanced the acceptance of triticale for hay because of its long straw and softer heads with a low degree of awning, coupled with cereal cyst nematode resistance," she said.

Kath believes mixed enterprise growers in drier farming regions could benefit from growing triticale instead of rye, which has

fewer market uses. “Growers in low rainfall regions use rye quite a lot. It has an even bigger root system and produces even more straw than triticale but is used for little other than baking bread.

“I’d say if you’re growing rye, have a look at some of the more recent triticale varieties selected on our drought-prone farm, which are considerably better for livestock feed than cereal rye. Goanna, for example, has good grain quality and produced the best grain yields on our farm last season.

“Yowie has a little longer growing season than Goanna but still has some drought tolerance. We think its really big root system enables it to access moisture from depth and it seems to go into dormancy during dry periods then come back when conditions allow. I’m sure different varieties escape or deal with drought in different ways, but without research into drought tolerance mechanisms we are stuck with anecdotal reports and guesses as to the mechanisms at play.

“I talk about triticale being good for drought conditions and being economic on lower inputs because that is what we see on our farm, but it prefers more rainfall and higher inputs and the more you put into this crop, the more it will return.”

Kath believes triticale can help growers maintain productivity in the face of climate change but says everyone needs to ‘do something to limit climate change and not just assume that farmers have to adapt’.

“You need some rainfall to get crop growth; you can’t grow it on fresh air. Biological systems can only cope with so much and enzymes will only operate in a certain temperature range, so if we get too hot then things are not going to work.”

LOADING THE TRUCK OF A NSW GROWER WHO DROVE TO KATH AND MIKE’S PROPERTY TO BUY 10 TONNES OF TRITICALE SEED HE HOPES WILL MAKE HIS FARMING SYSTEM MORE RESILIENT IN THE FACE OF DRY CONDITIONS DURING THE GROWING SEASON.

Triticale copes well with frost when in vegetative growth stages but, like other cereals, is susceptible to frost damage at heading, with the extent of damage depending on the duration and severity of the frost.

Kath has dedicated most of her career to progressing triticale as a crop option and there is no sign of her determination abating. “I’ve had a lot of experience with it and I think it’s a great crop. It’s simple to grow and very rewarding. It gets under your skin really. I’d be happy if other researchers and companies were funded to take it on and then I wouldn’t feel compelled to put so much effort into it, but at the moment it keeps me actively engaged in purposeful work, and even provides some fun.”

She is also buoyed by recent interest in the grain. “In August we had some last-minute orders from seed companies which cleaned out our stock, so triticale is still in demand.”

In an average year they produce 20 to 50 tonnes of each of their six triticale varieties, but last year the tough seasonal conditions reduced their production to about 12t of each variety.

Kath is frequently asked to present at Triticale Symposia around the world and in 2017 was awarded the prestigious David Roget Mallee Sustainable Farming Excellence Award in recognition of her contribution to the development, adoption, research and marketing support of triticale.

She still sees frontiers for the grain to conquer; particularly its acceptance for human consumption.

Kath has enjoyed eating food made with wholemeal triticale for more than 30 years and believes it has potential in health food markets in particular, since it is higher in fibre than wholemeal wheat. It also has what she describes as a pleasant mouthfeel and delicious slightly sweet and fragrant flavour.

“I live in hope that triticale wholemeal will make it in the food industry. If it had more visibility in the food industry the crop would have more stature within the general population and research community. I’ll keep battling on that front.”

MIKE ELLEWAY AT THE FRONT END OF THE SEEDING RIG USED TO PLANT KATH AND MIKE’S COMMERCIAL CROPS.

Storage part of triple threat business

KATHERINE MAITLAND

Balaklava grower Brett Roberts' on-farm storage is giving him a competitive edge in an increasingly volatile and competitive grain marketing environment.

Brett Roberts has developed an extensive farming business he hopes will remain viable well into the future.

A fifth-generation farmer who was an early adopter of on-farm storage, Brett farms at Balaklava, where he and his son Josh run a three-tiered business comprising Kemarob Limited, a primary production enterprise, grain marketing company Australian Growers Direct (AGD) and freight and logistic company Roberts Haulage.

Brett, who with more than 30 years' experience has seen seasons come and go, has maintained his passion for agriculture through all those experiences, which include receiving a Nuffield Scholarship in 1999 to study no-till farming and fertiliser application.

Kemarob has five full time employees who are part of a team of valued staff members Brett describes as integral to his success.

"We have an operations manager and an excellent Chief Finance Officer who handles all the accounts and receivables plus farm administration and is part of the grain purchasing, customer relationship and logistics structure for Australian Growers Direct (AGD), our grain marketing business.

BRETT ROBERTS CAN HOLD APPROXIMATELY 9,000 TONNES OF GRAIN IN VERTICAL STORAGE, WITH ADDITIONAL CAPACITY IN SHEDS, FIELD BINS AND GRAIN BAGS, WHICH IMPROVES HARVEST EFFICIENCY AND MARKETING FLEXIBILITY.

AGD POSTS GRAIN PRICES ON THE MAIN HIGHWAY DURING HARVEST TO KEEP LOCAL GROWERS IN TOUCH WITH SHIFTS IN THE MARKET.

"We like to think our business has a good working culture. We value people above everything else and are lucky to have a good bunch with a variety of management skills and abilities."

The trucking enterprise, which employs six full time drivers, is managed by Josh who also handles the farm logistics.

"Josh started the trucking business as a separate value-add enterprise. We had our own trucks on the road so it seemed logical to also cart for other local farmers.

"We transport all our own grain and grain from surrounding farms locally and interstate."

Brett runs a minimum-till cropping operation with no livestock in the system, but is well aware that mixed farming has been more profitable than high-input cropping in recent years, especially with lamb prices being significant.

He has storage capacity for approximately 9,000 tonnes of grain in sealed and aerated vertical storage, with additional storage available in sheds, field bins and grain bags, which gives him control of his grain and increases marketing flexibility.

Having the storage and facilities to hold and dry grain maximises harvest efficiency by enabling Kemarob to harvest crops when they are ready and gives the business more control of its grain in the market place.

Depending on the circumstances, they can dry or blend grain to meet specific market requirements or simply hold grain until the market is right.

"Storing grain is not hard. If you're smart enough to grow it, you're smart enough to store it.

"The key is to have multiple types of storage. That way, every piece of storage has its place for certain situations.

"Having storage takes the pressure off during harvest. We can hold grain for extended periods until we want to sell.

With some of the minor crops, like chickpeas and lentils, there might not be a market when the crop comes off.

"Being able to hold grain on the property without the risk of spoilage also allows us to minimise freight costs by avoiding freight cost peaks at harvest time.

"However, our overriding preference, even with our storage capacity taken into consideration, is to sell the grain for a reasonable price as soon as we can, which means we do deliver grain straight away when that is required.

"Every type of storage has its place. Bolster grain bags are really useful because you can leave grain in them right up until seeding starts."

As one of the pioneers of on-farm storage in the Mid North Brett has encountered issues with insect infestations and moisture levels over the years.

"We have strategies in place for each type of storage, including gas and fans in our vertical upright silos. We have to ensure bags are perfectly sealed to avoid any mice or moisture infiltration."

Brett says storage itself is not expensive but the equipment needed to complete the infrastructure and enable it to be used well is.

"You can spend twice as much on elevators, chutes and augers as on the storage itself," he said. "That's why we have invested more in bags in recent years.

"I have also learnt that you don't have to fill all your storage just because you have capacity available. We still cart grain straight from the paddock to receivers to generate cash flow and only sell if the daily price is good enough.

BRETT'S VERTICAL UPRIGHT SILOS ARE SEALED AND FITTED WITH FANS AND OTHER MECHANISMS TO MANAGE MOISTURE AND TEMPERATURE LEVELS OF GRAIN IN THE STORAGES.

"In this regard our storage is a good back up, but at some point you have to sell the grain," he said.

"There is now an abundance of on farm capacity in this area so there's more competition to get grain into the major systems, which has resulted in a good cash price at harvest in the past few years."

Brett has embraced precision agriculture, which he sees as an essential part of modern farming practices, but believes it is important to be discerning about what aspects of the technology have value in which situations.

"Precision agriculture can be daunting, but if you figure out what works for you and embrace what you wish to use it can be good value," he said.

"There are some facets of precision agriculture that suit me and others that don't. It's good to know where we are all the time, and to be able to operate with accuracy, but controlled traffic does not work for some of our country and is just a lot of time and effort for minimal result."

He uses variable rate technology (VRT) to tailor applications of cropping inputs including lime, gypsum, phosphoric acid, wetter, which he applies to non-wetting sandy soils, and pre-emergent herbicides,

"I like to do all the applications myself and mark the obstacles and identify soils in paddocks that are deficient," he said.

He feels precision ag may be having some unexpected consequences.

"I have noticed that once much-prized tractor driving skills are being somewhat lost with auto steer and precision agriculture. A lot of younger operators can't hand-steer a tractor anymore. The skill set now has changed to being confident in understanding and operating the guidance and controller systems."

But, whatever the skill set, Brett believes the agriculture industry needs to give greater recognition to the talent within the sector.

"We pay business consultants $100 an hour or more but a qualified tractor driver is on only $30 an hour. A pilot who does

the same amount of hours on a plane receives not only a better wage, but also recognition within his field.

"I hope we can value the wealth of talent we have out there in the industry."

He has standardised on John Deere technology, which provides data for management decisions, to manage the precision agriculture aspects of his business.

"The John Deere program allows me to monitor paddocks but I still like to drive around in the ute and see what's happening in the paddocks," he said. "Some of the data is irrelevant but some is of value. You can look at the information all day on your computer in the office, but at some point you need to get out there."

Dryland salinity has emerged as an issue on the property in the past 10 years, prompting Brett to include a lucerne phase in his farming system to lower water levels under the salinised areas.

"We have integrated lucerne into our cropping program purely to address the onset of dryland salinity and now have 5% of our farm under the legume.

"We are hoping the lucerne will address our salinity issue by using excess moisture and re-establishing the water table at its previous level."

He has also changed other practices in recent times to accommodate climate shifts and frost and has tried cover crops with the aim of increasing soil fertility and supressing weeds.

"Frosts are an issue in our region, but we can still manage them depending on the severity.

"We have changed our seeding program so we sow wheat at the end of sowing instead of the beginning and have adjusted our nutrition program, particularly by backing off on nitrogen.

KEMAROB AND AGD PRINCIPAL BRETT ROBERTS USES DATA BUT STILL LIKES TO GET OUT TO SEE WHAT'S HAPPENING IN THE PADDOCKS.

"We have grown different types of crops over summer, including grasses, and achieved the best results with sunflowers, but that was really just an experiment and we've decided not to continue with them."

Brett established a trading enterprise, Australian Growers Direct Pty Ltd (AGD), in 2004 with the aim of supporting SA grain growers to market their grain more skilfully, he said.

"AGD is a privately-owned organisation that aims to be a business partner for growers and traders. We have international and national links and arms of the business in Victoria and NSW."

The company posts updated grain prices on a large road-side board during harvest.

"Our trusted relationship with growers and customers is the key to our success," Brett said. "We support these relationships through an in-depth knowledge of local, domestic and global markets to link growers with our network of grain end users and customers."

He believes water issues and climate change are the key challenges facing agriculture, but sees land as 'the true wealth of agriculture'.

"My advice has always been to buy more land without going broke! Things are changing a lot in the banking environment to allow farmers to purchase land and capital wealth in land is the security.

"Our location in the lower Mid North is good for our businesses because we are close to domestic markets and Adelaide, but that also makes the price of land high.

"We have leased land in the past but buying land is always worth the investment."

Sopping up Mallee soaks

SARAH JOHNSON

Finding ways to limit the expansion of soaks on leased blocks at Wynarka is a new management challenge for Mallee grower Andrew Thomas.

Wynarka grower Andrew Thomas has joined an increasing number of Mallee farmers dealing with the waterlogging problem known as 'soaks' or 'seeps' formed by water seeping from perched water tables.

In the Mallee, a layer of 'Blanchetown Clay' about 700mm below the surface is believed to restrict the downward movement of water through the soil profile and channel it to discharge sites where it pools on the surface.

Soaks quickly become unproductive as waterlogging makes them difficult to traffic and the combination of waterlogging and high salt concentrations resulting from evaporation of the soil water when it reaches the surface make them hostile environments for plant growth.

ANDREW AND EMILY THOMAS.

HAVING SOAKS LIKE THIS ONE IN THE MIDDLE OF A CROP OF LUPINS REDUCES RETURNS AND MAKES PADDOCKS HARD TO MANAGE.

Andrew, who farms with his wife Emily and four sons aged between two and 12, is dealing with two significant soaks, each currently between two and three hectares in area, that are affecting up to 10ha of surrounding cropping land on two blocks he has recently leased at Wynarka. One is in the middle of a productive cropping paddock. The other is close to a fence line in a less productive area.

He was aware of both soaks before leasing the blocks, the first four years ago and the second two years later. "There have been seeps there for as long as I can remember. On the second place the soak has its own duck colony and a few frogs, so it's been there a while."

However, continuing expansion of the soaks is a cause for concern. "There's no production on those areas at all and they're getting bigger, so we'll start losing more land if we don't remedy the situation," he said. "Soaks can be located in or near some of the best paddocks on a property. The soak I have in a gully between two sand hills is in a paddock with very nice dirt, so you can start losing your most productive country."

Soaks are considered a consequence of continuous cropping and effective summer weed control. A period without growing plants, whether crop, pasture or weeds, means there is nothing to use moisture available in the soil profile, so it pools and drains. "In my eyes soaks are a symptom of modern farming because we're not utilising summer moisture," said Andrew. "In the past the skeleton weed soaked it all up but now we're actively controlling our summer weeds so we'll probably get more soaks developing. If we don't have plants growing in summertime and we're spraying summer weeds, then the moisture has to go somewhere."

There is no simple solution for managing soaks but Mallee farmers and researchers are currently trialling a range of strategies.

"Farmers are going through a trial period to work out how we can manage them, because we haven't found a silver bullet solution," Andrew said. "If they stay bare the evaporation process leaves a salt layer on the surface and establishing plants is one approach being tried to avoid that."

He is experimenting with two planting strategies suggested by Chris McDonough from Insight Extension for Agriculture, who led a led a four-year project researching soaks: sowing deep-rooted species around the perimeter of a soak and sowing salt tolerant species into it.

The project, which ran from 2015 to 2018 and involved trials on four soaks on properties between Karoonda and Mannum, was funded by Natural Resources SA Murray-Darling Basin (SAMDB).

In one of those trials, on Geoff and Kevin Bond's farm at Mannum, growing lucerne, a deep-rooted perennial legume, on land adjacent to a soak lowered the water table and Andrew has sowed 14ha of land surrounding one of his soaks to lucerne. The stand was established last season but he believes it will take at least two years for the roots to reach deep enough into the soil profile to access the underlying water. "It was a bit of a dry year to try to get the lucerne going but we had reasonable success with establishment. Time will tell."

This year, on the other soak on his property, he sowed a mix of puccinellia and tall wheatgrass – two grasses considered salt tolerant and capable of coping with some waterlogging – on a hectare of the soak with the aim of establishing a stand of plants to take up and use the available moisture for plant growth.

THIS AREA OF SOAK-AFFECTED LAND HAS BEEN SOWN TO PUCCINELLIA AND TALL WHEATGRASS, TWO SALT-TOLERANT GRASSES, BUT IT'S TOO EARLY TO TELL HOW WELL THEY WILL PERFORM.

The grasses were sown at the end of his crop seeding program so it is still too early in the process to see any outcome.

"I went out there the other day and saw that there's some growth, which is a promising sign, but they looked a bit stressed. I'm worried that they've established with fresh rain but may struggle with the salt content as evaporation increases. I'm hesitant to be overly confident until we see them growing properly but they're the sort of plants that can self-seed and keep going, so hopefully they will stay there forever."

Andrew used a four-wheel motorbike with a small set of harrows and 12-volt spreader to sow the puccinellia and tall wheatgrass mix. "We can't get on the soak with anything heavy," he said. "Some blokes with smaller soaks than ours have grown summer crops on them to try and absorb the moisture but we can't get a tractor onto ours. I get bogged every time I try to drive onto them. We tried driving through one last year thinking it would be fine after a long, dry winter and dry summer but we still got bogged."

Delving around a soak to break up the sub-soil clay layer is another option the Thomas family has considered for the soak arund which Andrew has established lucerne but the contractor was unable to do the delving planned last year, so Andrew deep ripped the area instead. "I don't think we did as good a job with the ripper as the delver would have done so I think we'll still go ahead with delving to use as much moisture as we can in the crop either side of the soak."

That idea stems from a spading and delving trial Chris McDonough did on another property at Wynarka. "It didn't fix the soak but it did utilise most of the rain that fell in that area, which is about stopping the soak from getting any bigger."

Chris is currently trialling the impact of a combination of soil amelioration techniques including use of a land plane to import soil and addition of organic matter at a site at Mannum, said Andrew. "It's quite an expensive process. They're basically scooping up lots of dirt and dumping it on top of the soak then spading in chicken manure and planting crops to try to revitalise the area. It's a soak that's right in the middle of a paddock, like one of mine. It would be nice to be able to drive through mine and not around it all the time, but revitalising it like that is probably a 10-year project."

The cost and timeframe associated with different treatment options is an important consideration for Andrew, who leases 920ha of his 1,320ha holding at Wynarka. To treat the soak in his more productive paddock he has removed 14ha

from his cropping program, gone to the expense of sowing and establishing lucerne on that area and is planning to go ahead with delving soil adjacent to the lucerne planting at a cost of up to $400/ha.

He also plans to plant trees near the soak planted with puccinellia and tall wheatgrass, which is near a fence on the edge of a paddock. "We obviously can't plant trees in the middle of a paddock and still drive a seeder through but this soak is near a fence line and increasing the number of trees is about finding another way to use up the moisture there.

"There are two ways of looking at it with a leased property. I've discussed it with the owner and he said we can do what we want, but you don't want to spend a fortune because it's not your country. At the same time, the landowner doesn't want to see the soak getting bigger and we want to do the right thing and maintain the relationship."

Andrew hasn't changed any inputs on the crops near the soaks, such as nitrogen applications, but says ryegrass is a particular problem near the edge of the soaks. "We sow as close as we can to the soak but the ryegrass usually gets quite bad in those areas. It thrives because there isn't any competition and there's plenty of moisture. It can be a bit of an issue, but it's just a management thing. We've got to try and control it."

A PEISOMETER [IN WHITE TUBE] HAS BEEN INSTALLED TO MONITOR MOISTURE LEVELS UNDER THIS SOAK, WHICH HAS WATER PONDING ON THE SURFACE FOR MUCH OF THE YEAR.

The Thomas's efforts are being supported by Chris McDonough who has carried out EM mapping of the two affected paddocks, installed peisometers at four locations around the soaks to monitor the water table, and dug soil pits to explore the detail of the soil profile.

"When Chris was digging into the soil profile to install the peisometers he found there is really wet clay seven metres down from the peak of the hill and four or five metres down from the side of the hill," Andrew said. "We thought the Blanchetown clay layer at a depth of 700mm was stopping further infiltration but it is very wet deeper in the soil profile so moisture must be getting through or under that top clay layer."

SANTFA
CONSERVATION AGRICULTURE IN ACTION

SPONSORS' SOCIAL MEDIA AND WEBSITE DETAILS

SPONSOR	TWITTER	FACEBOOK	YOUTUBE	WEBSITE
AV Weather	@AV_Weather	A.V.Weather		avweather.net
Cropping Solutions				croppingsolutions.com
Glencore Grain				glencoregrain.com.au viterra.com.au
GRDC	@theGRDC	Grains Research and Development Corporation	the GRDC	grdc.com.au
Grain Growers	@GrainGrowersLtd	Grain Growers	Grain Growers Limited	graingrowers.com.au
John Deere	@JohnDeere	John Deere		deere.com.au
Manutec	@ManutecAUS	Manutec Pty Ltd	Manutec Australia	manutec.com.au
Needham Ag		Needham Ag Technologies, LLC	NeedhamAg	www.needhamag.com
Tillage Radish		Agf Seeds		agfseeds.com.au
SANTFA	@SANotill	SANTFA	SANotill	santfa.com.au