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## FRONT COVER

### AVOID DELVING INTO 'DIRT NIGHTMARE'



Southern NSW-based soils researcher Cassandra Schefe encourages growers to be cautious if considering delving treatments. See article in Southern Focus.

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## In this issue...

### Search for drought-tolerant chickpeas

Drought-tolerant chickpeas that are highly efficient at extracting water from the soil are on the drawing board, with researchers employing novel technology to speed their search of genetic material.

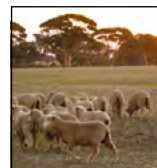
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### What's the best sheep flock structure and cropping balance?

The strategic management of a mixed enterprise farm system is often a challenge – the decision maker needs to consider the range of factors that can affect the relative profitability of each enterprise component, as well as how the components interact.

**See article . . . . . Page 12**



### Retardants with protection and benefits

Stubble retention has emerged as a key ingredient in modern and sustainable Australian grain farming systems. But over our typically long and hot conditions pre and post harvest, retaining stubble comes with the risk of fire.

**See article . . . . . Page 18**



### Now and then!

For nigh on 30 years, readers of this and other magazines produced by Greenmount Press, have been required to tolerate my epistles relating to the history of farm tractors, plus the pioneering days of agriculture in Australia and perhaps too frequently, my somewhat egocentric personal memoirs.

**See article . . . . . Page 30**



### Genetically engineered moth could herald new era of insect control

A new study reports a successful, first-ever open field release of a self-limiting, genetically engineered diamondback moth (DBM), stating that it paves the way for an effective and sustainable approach to pest control.

**See article . . . . . Page 39**



**A** CONTINUATION of dry conditions helping to fuel devastating bushfires, was not the way we had hoped to say goodbye to a forgettable 2019 and to welcome in a brand new – and hopefully much wetter – year. But finally in late January, and across a large swathe of the nation's northern cropping region, some beautiful rain arrived with the promise of more to come as we move into February. In a number of areas, there was even enough of the wet stuff to entice planters out of the shed and into moist paddocks to be sown to late sorghum or mungbean crops.



January rainfall totals of 100 to 200 mm were recorded for much of the Central Queensland cropping districts while in southern Qld, the totals were variable, typical of summer storms, but were generally close to 100 mm. Northern and Central New South Wales, as well as the long-suffering Liverpool Plains district, finally got under some excellent rain and recorded January totals of 50 to 100 mm and better.

This very welcome change in weather patterns has come at a time when both the Indian Ocean Dipole (IOD) and El Niño–Southern Oscillation (ENSO) have moved into neutral territory. It's hard to deny the influence these climate phenomena have on weather patterns across Australia. For instance, up until early January this year, the IOD had been sitting in positive territory for six months and was influencing the trajectory of weather systems which had formed in the Indian Ocean as they moved eastward across Australia. The IOD became neutral in January – and it starts to rain!

As Peter McMeekin points out (see page 26) with both the IOD and ENSO now in neutral territory we start 2020 with fewer impediments to more 'normal' weather patterns.

### Flame retardant research

The recent bushfires have brought home the need for the right plans and strategies to be in place when each year, like clockwork, we enter our high fire danger periods. Some very edgy research from South Australian No-Till Farmers Association looks at the role a new generation flame retardant, doubling up as a phosphate fertiliser, might play in strategic fire management leading into – and after – harvest (see page 18). Also on the fire management topic, we report on some US research which shows that controlled burning of their rangelands not only restores soil health but promotes better quality pasture growth.

"Fires are going to happen, so isn't it better to control the conditions, and decide what you want burned, and when and where you want to burn it, rather than waiting for a wildfire to break out and burn unchecked?" asks the USDA's Lance Vermeire.

It's high time our national and state forest authorities and local councils embraced that very simple, but life and property preserving, sentiment.

Here's hoping for wetter weather patterns to re-emerge in the coming months.

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# What's the sticking point? Better pre-em efficacy in stubble systems

■ By Cindy Benjamin

### ***Sticking point (noun)***

*An obstacle to progress towards an agreement or goal: Herbicide adsorption on stubble is a sticking point in the adoption of pre-emergent herbicide use in no-till stubble retention systems.*

**P**RE-EMERGENT herbicides are a valuable tool to underpin crop competition and suppress weed seed production in-crop, but when growers also want to harness the power of retained stubble they often run into a sticking point where pre-emergent herbicide efficacy is compromised.

Most growers and advisors are aware that products such as trifluralin are quite tightly bound if they contact stubble during application, but AHRI research associate Dr Yaseen Khalil has been working to shed light on the behaviour of the newer pre-emergent herbicides and how to use them in no-till, stubble retention farming systems.



**Yaseen Khalil is researching the best ways to use the newer pre-emergent herbicides in stubble retention systems.**

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To be effective, pre-emergent herbicide must be placed in contact with the soil and an even layer of the chemical is required to intercept germinating weeds.

In his latest research Yaseen has shown that ground cover is more important than crop residue type or age when it comes to intercepting pre-emergent herbicides.

### **Crop type and age**

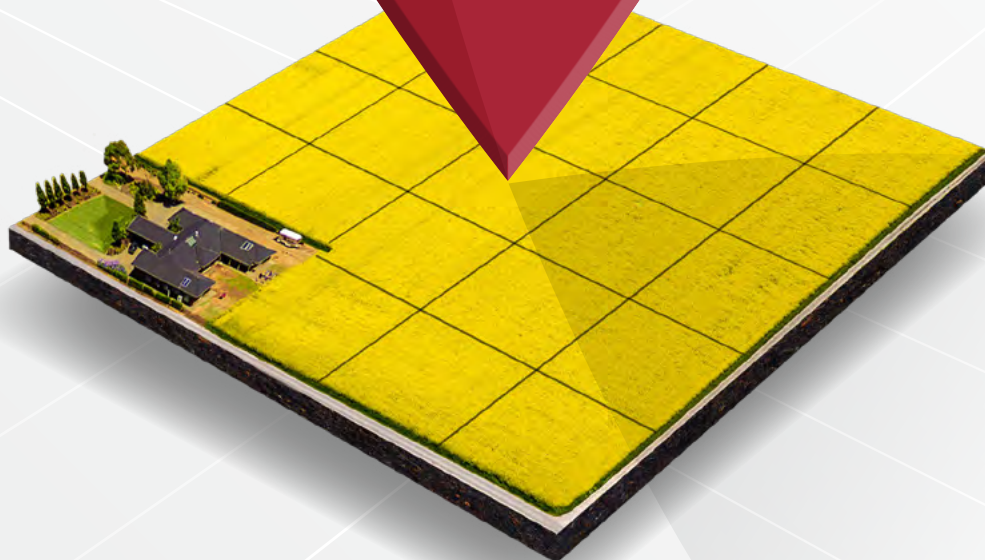
Yaseen's previous work had looked at the behaviour of prosulfocarb (Arcade/Countdown), pyroxasulfone (Sakura), and trifluralin (Treflan) on wheat stubble. In this new research he has set his sights on finding out if other crop residues (barley, canola, chickpea and lupin) behaved differently to wheat stubble and





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if the age of the residue had an impact on the interception and subsequent leaching of the three herbicides from the crop residue into the soil.

For the same mass of residue, barley and wheat intercepted more herbicide than canola, chickpea or lupin residue. The effect of residue age on herbicide interception and leaching was relatively small and variable.

### Ground cover is king!

It makes sense that the higher the ground cover percentage, the greater the extent of herbicide interception by the stubble. Yaseen found that the mass (amount), type and age of the residue are far less important than the level of ground cover at application.

For the same mass of residue, lupin stubble provided the least ground cover, followed by chickpea, canola and the cereals (wheat and barley). Cereal stubble at four tonnes per hectare provides more than 90 per cent ground cover while the same amount of lupin stubble provides just 27 to 44 per cent ground cover.

A key factor when using herbicides with high levels of crop residue is to ensure that sufficiently high rates of the chemical are used along with high carrier/spray volumes, as shown by Catherine Borger and Glenn Riethmuller. These researchers found that increasing the carrier volume from 30 to 150 litres per hectare improved the average control of ryegrass by trifluralin and Sakura from 53 to 78 per cent.

### Rules of thumb for annual ryegrass control

#### Treflan (trifluralin)

- Is only effective where there is little to no crop residue present;
- Washes off best when applied to dry crop residue; and,
- Requires incorporation into the soil by rainfall or mechanical means within 24 hours of application.

#### Arcade (prosulfocarb)

- Is only effective where crop residues are less than two tonnes per hectare;
- Washes off best when applied to dry crop residue; and,
- Some control of annual ryegrass is achieved if five mm or more of rain falls within seven days of applying prosulfocarb.

#### Sakura (pyroxasulfone)

- Is still effective when crop residue load is four tonnes per hectare;
- Washes off easily when it is applied to either wet or dry crop residue;
- Provided 100 per cent control of annual ryegrass when just five mm of simulated rainfall was applied 14 days after herbicide application; and,
- Sufficient herbicide reaches the soil when the harvest height is 30 cm or less. Higher harvest height may start to reduce the amount of herbicide reaching the soil surface.

### Stubble standing v laying

Cutting wheat crops high, leaves less crop residue on the soil surface and this improves spray coverage of the soil and herbicide efficacy.

The higher the biomass of the crop the greater the benefit of cutting high. Yaseen found that as the amount of horizontal wheat residue increased from 0 tonnes per hectare (i.e. all residue standing to a harvest height of 30 cm) to four tonnes per hectare (i.e. harvested at ground level and all residue laying horizontally on the ground), less Sakura reached the soil surface. With all the wheat residue standing, spray coverage on the soil was 14.6 per cent compared to 7.5 per cent coverage when the four tonnes per hectare stubble load was laying on the soil surface.

When one tonne per hectare wheat stubble is laid horizontally on the soil surface, the spray coverage of the soil was 10 per

cent. When the one tonne per hectare stubble load was left standing, an extra five per cent of the herbicide spray is deposited onto the soil surface.

Increasing harvest height is a practical way to reduce ground cover of the soil while maintaining high levels of stubble in the field. This may assist with spray coverage but if you are doing harvest weed seed control, lower harvest height is usually required to capture the weed seed present.

Another consideration is the speed of the boomspray – faster spraying speeds generates more horizontal droplets leading to increased deposition on standing stubble.

### Mix and rotate according to ground cover

Rotation and mixing of pre-emergent herbicides within the crop rotation is a key tactic to manage herbicide resistance. This research supports the idea that growers can choose to rotate pre-emergent herbicides based on the level of ground cover left after the previous harvest.

For example, plan to use Sakura after bulky cereal crops and rotate to other pre-emergent herbicide options in situations where there is less stubble covering the soil surface.

If there is rain expected within a week it may be possible to use Arcade, or trifluralin if incorporation by sowing is an option, to avoid over-use of Sakura.

Rainfall after application of pre-emergent herbicide increased herbicide efficacy for all residue amounts.

Where possible, avoid applying pre-emergent herbicides to wet stubble.

#### Related AHRI Insights

We first reported on Yaseen's research in AHRI INSIGHT 'Herbicides and stubble – some wash off, some don't' (April 2017) where he compared pyroxasulfone (Sakura), trifluralin (Treflan) and prosulfocarb (Arcade) herbicides by spraying them onto wheat stubble then trying a whole range of techniques to wash the herbicides off the crop residue with simulated rainfall. [Link to <https://ahri.uwa.edu.au/herbicides-and-stubble-some-wash-off-some-dont/>]

In another AHRI Insight 'Pre-emergent herbicides in stubble – Strike or foul?' <https://ahri.uwa.edu.au/pre-emergent-herbicides-in-stubble-strike-or-foul/> we explored the use of this information in a dry sowing situation. ■

## BOOM SET-UP ALSO MAKES A BIG DIFFERENCE

In addition to increasing water volume, there is also a lot than can be done with boom set-up to maximise the amount of herbicide spray reaching the soil in standing stubble systems.

- Drive with the rows, not against them.
- Use large droplets (VC or larger) and use fast moving solid droplets over slower moving air-filled droplets.
- Travel speed less than 20 km per hour will result in less stubble interception.
- Keep boom height low, use narrow fan angle nozzles and consider 25 cm nozzle spacing.
- When using 110 degree nozzles at 50 cm spacing, the droplets at the edge of the fan pattern are moving quite horizontally, and will therefore get captured in stubble rows, especially with higher boom height release.
- Narrowing nozzle spacing to 20 or 25 cm, keeping boom height low, and using 80 or 65 degree nozzles will result in a much larger percentage of droplets travelling more vertically and hence more likely to reach the soil.

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# Technology accelerates search for drought-tolerant chickpeas

**D**ROUGHT-TOLERANT chickpeas that are highly efficient at extracting water from the soil are on the drawing board, with researchers employing novel technology to speed their search of available genetic material.

As part of research conducted with Grains Research and Development Corporation (GRDC) investment, Helen Bramley, a senior lecturer at the University of Sydney, and her research team have developed a new way to quickly screen chickpea genotypes for water-use efficiency.

## Reduce the release time

The aim is to reduce the time taken to release drought-tolerant chickpea varieties to growers.

"The traditional approach involves inserting aluminium access tubes into the soil to measure soil water content using a neutron probe," Helen says. "But installing the tubes and taking the measurements at different depths is time-consuming and labour-intensive."

Accordingly, the team was keen to find a more accurate and efficient, less time-consuming and non-destructive method for gathering water-use data across a large population of trial plots at critical periods.

"I saw the University of Sydney Professor of Digital Agriculture and Soil Science Alex McBratney give a presentation that described various technologies for measuring the soil properties, which included electromagnetic induction (EMI). EMI measures the apparent electrical conductivity (ECa) of soil or how salty the soil is," she says.

"Because there is generally a relationship between ECa and moisture content, I asked Alex if it was possible to adapt the technology to measure soil water use in chickpea plots. He said it could be possible."

Subsequently the team used an EM38-MK1 sensor, a one-metre-long instrument capable of collecting electrical conductivity (ECa) data. A model – calibrated against neutron probe measurements – was also developed to calculate available soil water for different depths within the soil.

At the end of 2017, a proof-of-concept experiment was established using 36 different chickpea genotypes. Some were rainfed while others were irrigated because of dry seasonal conditions.

"Using the EM38 sensor, we were able to calculate water use for the plants in every plot as well as at different soil depths after a rainfall event," Helen says.

## Identify deep-rooted chickpeas

"Being able to measure moisture at different depths allowed us to pinpoint where in the soil the plants were extracting water from."

As a consequence, Helen says the technology has enabled the team to identify the chickpea genotypes with deeper roots, which may be one of the traits important for drought tolerance.

A prototype buggy, called the BrEM38, was also developed to ease the task of taking thousands of water-use measurements throughout the year.

The buggy, which operates at different heights, was constructed by Chris Bramley entirely from plastic to fit over the plots and run on wheels to improve the speed of data collection. No metal was used in the construction because it could interfere with the EMI measurements.

Going forward, Helen hopes the process of collecting water-use data can be further automated using robotics.

"My vision is that we will soon have multiple robots operating at various locations across Australia that continuously collect this data from the field," she says. ■



Dr Helen Bramley and her research team at Sydney University have used electromagnetic induction and other technologies to increase the efficiency of varietal screening. (PHOTO: Nicole Baxter)

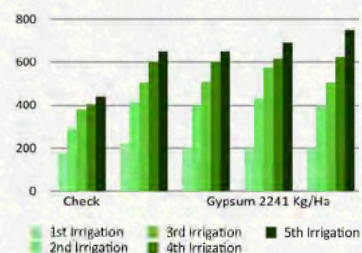




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# What's the best sheep flock structure and cropping balance?

■ By Michael Young<sup>1</sup>, Prof Ross Kingwell<sup>1,2</sup>, John Young<sup>3</sup> and Prof Philip Vercoe<sup>1</sup>

## AT A GLANCE...

The strategic management of a mixed enterprise farm system is often a challenge. When completing a strategic analysis, the decision maker needs to consider the range of factors that can affect the relative profitability of each enterprise component, as well as how the components interact.

A strategic question currently facing many mixed enterprise broadacre farm businesses in Australia is: What sheep flock size and structure is most profitable and complements the cropping components of the farm businesses? This is of importance to many farmers because of the high sheep meat and wool prices.

This research provides findings to help answer this question for a typical large mixed enterprise farm business in the south-west of the WA wheatbelt. The results also have relevance for mixed farms in other states.

Whole-farm bioeconomic modelling, combined with broad-ranging sensitivity analysis, was used to analyse the profitability of different sheep flock sizes and structures.



Michael Young's focus mixed-farm research has pointed to an optimal cropping proportion of 40 to 50 per cent at current meat, wool and grain prices.

## How we did the research

The farm model employed in this analysis is known as MIDAS (Model of an Integrated Dryland Agricultural System), MIDAS is a whole farm linear programming model with a joint emphasis on biology and economics. The model's objective function is the maximisation of year-in-year-out (or steady state) farm profit, generated by selecting the optimal suite of activities whilst recognising constraints on resource availability.

For this analysis MIDAS input data was altered to represent the technical management and characteristics of the focus farm. These factors included mix of soils, land area, crop yield relativities, pasture production, sheep genotype and production, labour availability, machinery investment and work rates. This

process of model construction and calibration occurred over several months in close collaboration with the farm manager, ensuring the model accurately portrayed the farm business.

The different flock structures (Table 1) were compared at various price scenarios for meat, wool and grain (Tables 2 and 3).

## What we found

### Flock structure

Whole farm profitability varied by \$630,000 per year between the least and most profitable flock structures evaluated (Figure 1),

**TABLE 1: A description of the flock types included in this analysis**

Flock	Description
Store	A self-replacing Merino flock with emphasis on wool production. Wethers sold as store lambs to other farmers (6 months).
Export wether (Shipper)	A self-replacing Merino flock with emphasis on wool production. Wethers sold as shippers (18 months or older)
Merino prime lamb (MPL)	A self-replacing Merino flock with emphasis on wool and meat production. Includes the options above with the additional option of selling finished Merino lambs (10 months)
Trade wether	Buy in store wethers, sell as shippers (18 months or older). Emphasis on wool production.
Self-replacing crossbred lamb (SRF-MTS)	A self-replacing Merino flock utilising surplus ewes (cast for age or surplus ewe hoggets) for 1st cross lamb production sold as suckers <sup>1</sup> (4.5 months). Merino wethers can be sold as Merino prime lamb or as shippers. Emphasis on meat and wool production.
Specialised crossbred lamb production (Specialist-MTS)	Replacement Merino ewes are bought in. All ewes are mated to produce 1st cross lambs sold as suckers <sup>1</sup> (4.5 months). Emphasis on meat and wool production
Composite	Composite ewes mated to composite rams to produce composite lambs. Wethers sold as suckers <sup>1</sup> (4 months) Emphasis on meat production.

<sup>1</sup> Lambs which are still dependent on their mothers for milk.



illustrating the importance of flock selection for mixed farm businesses. The most profitable structure was the Specialist-MTS flock turning off first cross finished lambs. This is because these flocks produced large amounts of high quality wool from the Merino ewes whilst also turning off large quantities of high quality finished lamb. But to achieve high profit levels these flocks required a higher level of management skills because they are run at higher stocking rates and have greater sensitivity to weaning weights.

Running higher stocking rates and maintaining sufficient

**TABLE 2: Sheep sensitivity parameters in the analysis**

	Lamb (\$/kg) <sup>1</sup>	Shipper (\$/hd)	Ewes (\$/hd) <sup>2</sup>	Wool (c/kg) <sup>3</sup>
High (+20%)	7.20	114	102	1800
Standard	6.00	95	85	1500
Low (-20%)	4.80	76	68	1200

1 Merino prime lamb price. Wether lambs six months old sold to other grazier have a 37 c/kg discount and Crossbred lambs have a 20 c/kg premium.  
2 Price for a five-year-old, six-year-olds are discounted \$15 per head and ewe hoggets have a \$20/hd premium.  
3 Western market indicator price (c/kg) clean 21 micron wool.

**TABLE 3: Grain prices used in sensitivity analysis**

	Wheat (\$/t)	Barley (\$/t)	Oats (\$/t)	Canola (\$/t)	Lupins (\$/t)
High (+20%)	354	354	282	648	366
Standard	295	295	235	540	305
Low (-20%)	236	236	188	432	244

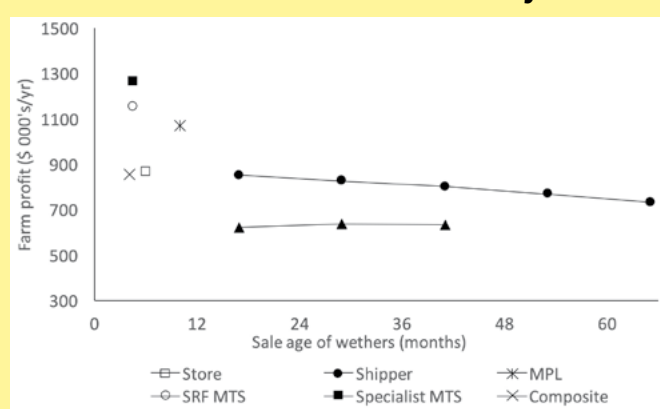
weaning weights requires appropriate ewe management and feed allocation.

The findings in this study are consistent with the general trend observed in Western Australia – and many other sheep producing regions of Australia – where the number of retained wethers relative to ewes is decreasing. Currently wethers only make up 11 per cent of the national sheep flock (ABARES, 2018). Additionally the proportion of ewes joined to terminal sires is increasing. This provides confidence that the industry is moving in the right direction.

### Crop and livestock integration

The optimal cropping proportion for the focus farm is between 40–50 per cent, although cropping proportions as low as 20 per cent and as high as 80 per cent are still economically viable.

**FIGURE 1: Whole farm profit for each of the flock structures evaluated in this analysis**



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Within 30 to 70 per cent cropping, farm profit is affected more by selecting the optimal flock than altering crop allocation (Figure 4)

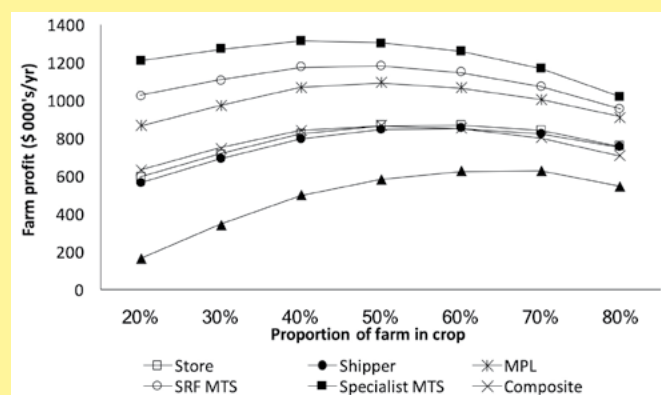
This suggests that farmers should first focus on implementing the optimal flock structure before making changes to their cropping allocation. But if farmers are satisfied with their flock structure, profit can be increased by shifting their crop allocation to between 40–50 per cent.

This is lower than the current average in the south west region of Western Australia, which is on average, cropping 64 per cent of agricultural land (ABARES, 2017).

Reducing the proportion of the farm in crop from 60 to 50 per cent increases farm profits by up to \$45,000. Additionally, selecting the correct rotation for each soil type is important. Selecting the wrong rotation can reduce profits by up to \$170 per hectare.

It is most profitable to have continuous pasture on the less productive soils and continuous crop on the more productive soils.

**FIGURE 2: Farm profit curve for each flock structure option over a range of cropping proportions**



### Price sensitivity

Increasing the meat price increases the relative profit of flocks turning off finished lambs and decreasing the meat price decreases the relative profit of flocks turning off finished lambs.

In contrast, increasing the wool price increases the relative profit of the flocks retaining wethers and decreasing the wool price reduces the relative profit of retaining wethers.

This means flocks that produce a balanced mix of both wool and meat are less sensitive to changes in either wool or meat prices. Price variation has the greatest impact on the profitability of flocks based on a composite genotype (meat emphasis) and merino flocks selling wethers as shipper (wool emphasis). But

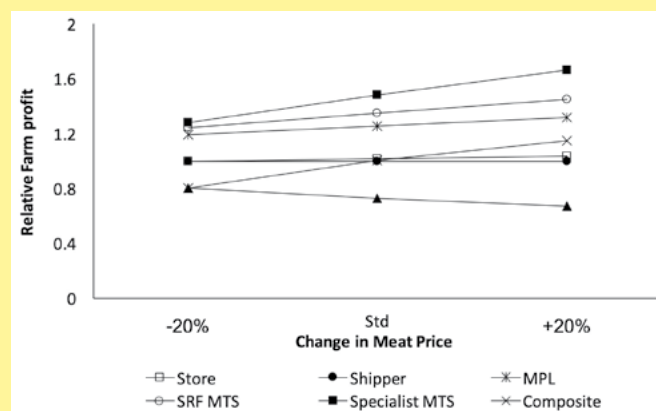
optimal flock structure choice remains robust to price changes as large as 20 per cent (Figures 3 and Figure 4). This can provide farmers with greater confidence in their choice of flock structure in the face of market uncertainty.

Grain is a major input for the sheep enterprise whilst being the key output of the cropping enterprise.

A 20 per cent increase in grain price shifts the optimal cropping proportion towards 70 per cent and increases farm profit by up to 18 per cent. Even with the increase in grain price (supplement cost), it is still optimal to have Merino flocks turning off finished lambs (Figure 5).

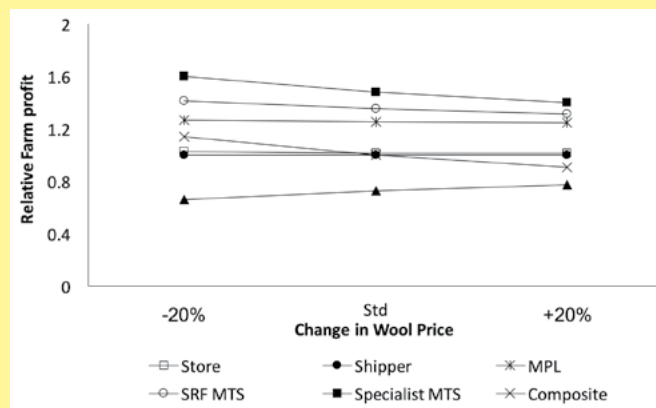
A 20 per cent decrease in grain price reduces the farm profit and optimal crop allocation because of the access to cheaper supplementary feed. But again, a 20 per cent change in grain price either way doesn't alter the optimal flock structure.

**FIGURE 3: Farm profit for each flock structure relative to the shipper flock selling at 17 mo (whole farm profit of a given flock divided by whole farm profit of shipper flock), when the meat price is reduced by 20%, standard and increased by 20%**



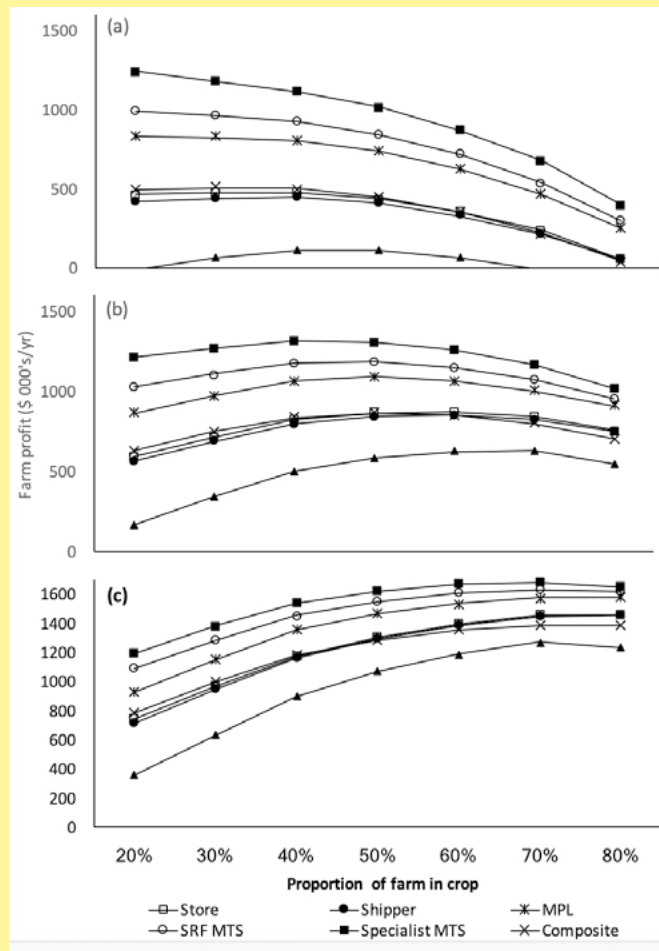
The profits presented in these results are presented relative to the profit of the shipping flock selling wethers at 17 months old. Relative profit was calculated to remove the impact of price changes on absolute profit levels, to highlight the differential impact of price changes between flocks.

**FIGURE 4: Farm profit for each flock structure relative to the shipper flock selling at 17 mo (whole farm profit of a given flock divided by whole farm profit of shipper flock), when the wool price is reduced by 20%, standard and increased by 20%**





**FIGURE 5: Farm profit for each flock structure at a range of cropping proportions when grain price is altered**



(a) – grain price reduced by 20%  
 (b) – grain price standard  
 (c) – grain price increased by 20%

## To sum up

This analysis illustrates that flock structure, rotation and crop allocation are all factors that have a significant impact on profit and need to be considered when determining farm strategy. The analysis in this study also indicates that it is most profitable to run a Specialist-MTS flock.

But all three Merino flocks turning off finished lambs were very profitable. These flocks remain most profitable if key input prices and commodity prices change.

But to achieve the maximum profit, these flocks require more attention to sheep management.

Furthermore, a feature of the optimal farm strategy was to commit to continuous pasture on the poor soils and continuous crop on the more productive soils.

Finally, it was found that allocating 40–50 per cent of the farm to cropping was optimal, although this was affected by relative commodity prices.

The results from the research tend to agree with the currently observed direction of the industry regarding flock structure, although the industry could increase profits by reducing the level of cropping and increasing flock size.

**Authors:** 1. The University of Western Australia; 2. Australian Export Grains Innovation Centre; and, 3. Farming Systems Analysis.

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# Aussie seeds shoot for new markets

**N**ARACORTE Seeds and its export arm, South Australian Seed Marketers has achieved significant growth in the past two years with exports steadily increasing to account for about half of all sales.

While the company has more than 400 seed types available domestically, its export portfolio is focused on about 20 key forage varieties including lucerne (alfalfa), clovers and some grasses.

Major export destinations include the US, the Middle East, China, Europe and South Africa.

Naracoorte Seeds Managing Director Jamie Tidy and his wife Peta have travelled to the European Seeds Association's Euroseed Congress the past two years and are starting to see the benefits of meeting in person with industry leaders.

Their trip to the 2019 conference in Stockholm in October was partially funded by a South Australian Export Accelerator grant.

Jamie likened the Euroseed experience to speed dating – a number of fast-paced meetings with businesses from all over Europe – which had led to exports to Italy, Germany, Spain, Portugal, France and The Netherlands.

"We sold quite a few containers while we were over there," he said. "Export wise you don't necessarily need to have a huge team of sales reps. The people overseas just want reliable supply and a genuine relationship and we think there's a lot more opportunity within our region."

Naracoorte is in the south east of South Australia, a region known as one of Australia's leading small seed growing areas.

Lucerne seed has been a big growth area for Naracoorte Seeds in recent years and accounts for almost half of the company's exports. Saudi Arabia is its biggest lucerne customer, where it is grown in the desert under huge centre pivot irrigation systems fed by underground aquifers. The lucerne is then cut into hay and fed to cows housed in enormous air-conditioned dairies.

More than 80 per cent of Australia's average annual lucerne seed production of 9700 tonnes is in South Australia's South East



**Jamie and Peta Tidy at Euroseeds 19 in Stockholm in October.**

around the area of Keith, Naracoorte, Tintinara and Bordertown, encompassing more than 16,000 hectares of irrigated and dryland lucerne.

"Lucerne is the king of forage – you can do hay, you can graze it, seed, silage, pasture mixes with companion species and the bee keepers flock to it now."

Jamie said the relatively lower Australian dollar had made Australian seeds significantly more competitive on global markets than five or six years ago.

"Six years ago when the Aussie dollar was on parity with the US dollar we just couldn't compete on the export market so definitely the growth in exports in the past couple of years have reflected the lower Australian dollar and us being more competitive not only from a growing perspective but currency as well," he said.

Jamie's business partner Joshua Rasheed is currently in Argentina trying to establish a new export market.

"No one is putting any effort in there and in business if you zig when others are zagging or zag when they're zigging then that's when opportunities come," Jamie said of the Argentinian venture.



**Hot summers and slightly salty irrigation water makes the region of Keith in the South East of South Australia ideal for growing lucerne.**



**A Haifa White Clover seed crop.**



# Lucerne gains new disease defence

■ By Jan Suszkiw, Agricultural Research Service – USDA

**L**UCERNE (known as alfalfa in the US) is often called the “Queen of the Forages” due to its high yield, feed quality for ruminant animals, nitrogen fixation and pollinator habitat among other environmental services. But this royal member of the legume family is no match against the host of microbes that cause the disease complex known as “crown rot.”

Chemical controls aren’t effective against crown rot, and there are no genetically resistant lucerne varieties available to farmers. Now, a team of Agricultural Research Service (ARS), University of Minnesota (UM) and Donald Danforth Plant Science Center (DDPSC) scientists is exploring a ‘surrogate’ defence – one borrowed from a close relative of this legume.

According to Debby Samac, a plant pathologist who leads the ARS Plant Science Research Unit in St. Paul, Minnesota, crown rot damages the cells at the junction of the stems and roots (the ‘crown’) of lucerne plants, typically after the first couple of harvests. Such attacks reduce the number of stems and the ability of the plant to store carbohydrates, diminishing yields and winter survival.

Fungicides registered for use on lucerne in the US don’t persist on the roots or crown long enough to prevent the disease.

Efforts to develop commercial varieties with resistance using conventional plant breeding methods have so far fallen short. That, in turn, has limited farmers’ options for managing crown rot and minimising their losses. In the absence of resistance genes from lucerne, scientists turned their attention to barrel medic,

a clover-like relative whose leaves produce small, antimicrobial proteins called defensins.

According to Debby, who teamed with Andrew Sathoff, a former UM graduate student researcher now at Dakota State University, and Siva Velivelli and Dilip Shah – both with DDPSC – lucerne produces defensins in seeds, and these defensins have been used to protect potato plants from fungal diseases.

## In search of the right defensin

But the defensins from lucerne, spinach and tomato that the researchers tested either did not inhibit growth of lucerne crown rot pathogens or had limited activity. Instead, they needed a defensin that inhibited many fungal and bacterial pathogens – and barrel medic fit the bill.

To get started, the team identified the amino acid sequences of defensins produced by barrel medic and synthesised their core motifs, or essential elements. They then exposed spores of fungal pathogens and bacterial cells to small concentrations of the defensins to learn what effect this had on the microbes’ growth and survival.

One of the defensins tested proved more potent than the others used against the crown rot pathogens, which included *Phoma medicaginis*, *Colletotrichum trifolii* and *Fusarium* fungi, as well as *Pseudomonas syringae* and *Xanthomonas lucerne* bacteria.

These results illustrate how resistance characteristics in plants related to lucerne can be potentially useful in protecting the crop from disease. ■



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# Retardants with residual fire protection and soil nutrition benefits

By Greg Butler, SANTFA Research & Development manager

**S**tubble retention has emerged as a key ingredient in modern and sustainable Australian grain farming systems. But over our typically long and hot conditions pre and post harvest, retaining stubble comes with the risk of fire. For the past four years SANTFA has been researching some mitigating strategies and products to help lessen the risk of devastating crop and stubble fires.

After the Pinery fire in South Australia's Mid North in November 2015, we started searching for a flame retardant with three key characteristics:

- Safe to use for farm operators and on the land where food would be produced;
- Could be applied through normal spray nozzles; and,
- Would have residual efficacy so that it could be applied weeks or months in advance of a fire actually occurring.

We were also interested in any soil nutrition benefits that might be gained from the use of phosphate-based retardants.

Ammonium Poly Phosphate Phase 2 (APP2) – a commercial flame retardant product – was tested as a fire suppressant in stubble paddocks in 2017.

In addition to fire mitigation, using APP2 to reduce the risk of paddock fires, or suppress an already burning fire, appears to offer other benefits

including phosphorous inputs and the sequestration of long-term soil carbon.

APP2 and DAP both have very similar N:P ratios (N:P 18:20). The rate of APP2 required to mitigate fire in a surface broadcast spray is equivalent to a high rate of DAP fertiliser.

In 2017 a replicated trial was established on the northern Adelaide Plains to assess the nutrient benefit of phosphorous from APP2 applied to stubble that was subsequently burnt to a charred residue.

In this particular trial, the APP2 was applied to stubble, that was then burnt, before the paddock was sown to wheat.

APP2 has not been tested in the extreme conditions of a real wildfire but controlled burning experiments in our 2017 and 2018 trials showed that it can reduce the intensity of fire across stubble and increase the amount of charred carbon residue remaining on the soil surface after a stubble fire (see photo).

But the results showed that the price of APP2 – combined with the high application rates required to achieve meaningful fire risk reduction – makes it a high-cost fertiliser option. Although, other potential benefits were identified.

Unlike conventional phosphate fertilisers, the

broadcast application of APP2 does help to mitigate fires, and in doing so, leaves a level of crop residue (soil cover) after a burn. This is good for the soil's health with the provision of binding sites and habitat for beneficial soil micro-organisms.

But for strategic and economic use in modern Australian grain farming systems, a flame retardant needs residual staying power to last through our long fire danger periods.



The APP2 fire retardant can reduce the intensity of fire across stubble and increase the amount of charred carbon residue.



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**Overview:** Over the past 21 years, SANTFA has successfully promoted the benefits of no-till and conservation farming systems in South Australia and other regions.

In SA today, over 90 per cent of cropping farmers use a no-till method of farming. This is thanks in part to the contribution of innovative research, development and extension activities provided by SANTFA.

SANTFA has evolved over the years to ensure we remain relevant to our many hundreds of members. SANTFA puts a high priority on creating an environment where transformational technologies can be proposed and developed without fear or favour.



**Commercial sponsors:** John Deere Limited, AGF Seeds, Glencore Agriculture, GrainGrowers Ltd, Manutec, Needham Ag Technologies.

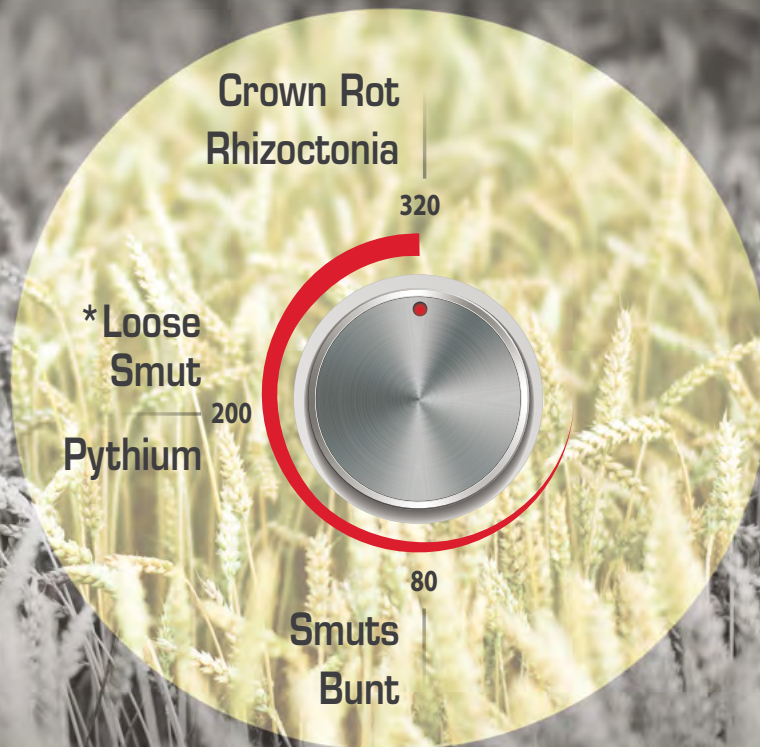




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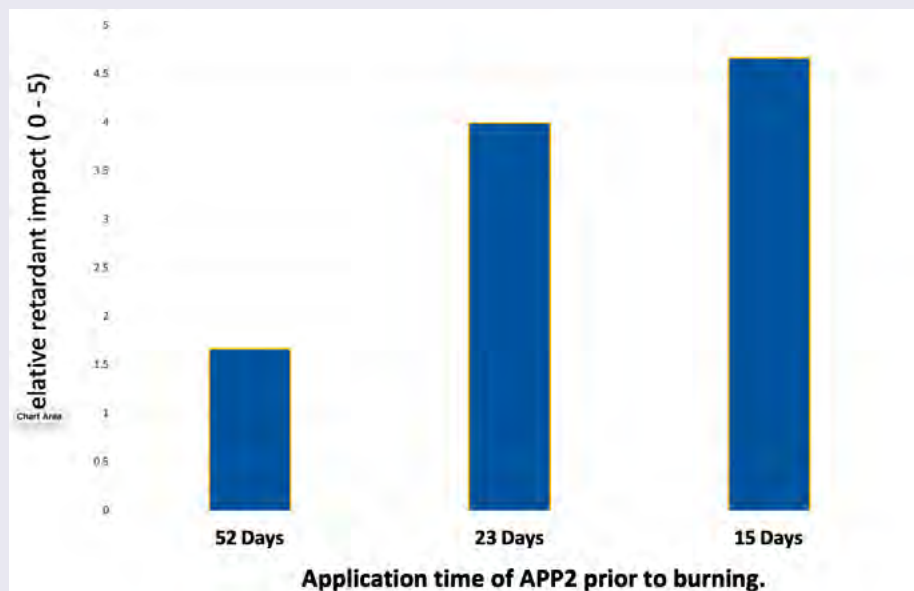
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\* Loose smut in Barley rate range is 80-200 mL/100 kg seed,  
higher rate is recommended for susceptible varieties.

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**Figure 1: Flame retardant effect of APP2 over time, SANTFA 2017 trials**



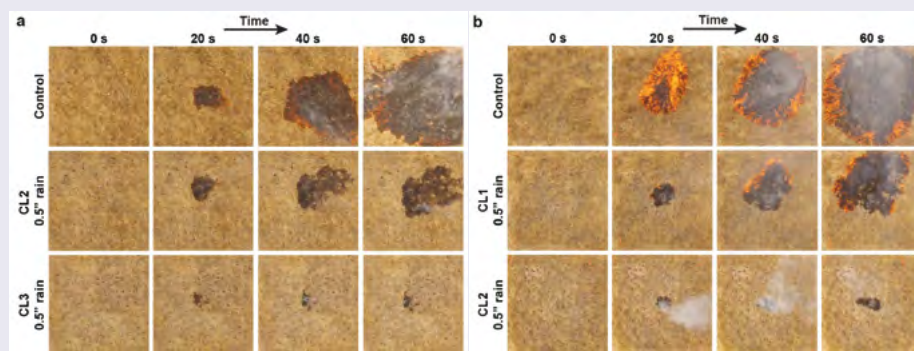
## Adjuvant breakthrough for residual fire protection

SANTFA's first two years of flame retardant product screening and field trials showed that traditional flame retardants can work well if sprayed onto the stubble just before ignition or directly on

the burning fire. The retardants had very limited residual effect.

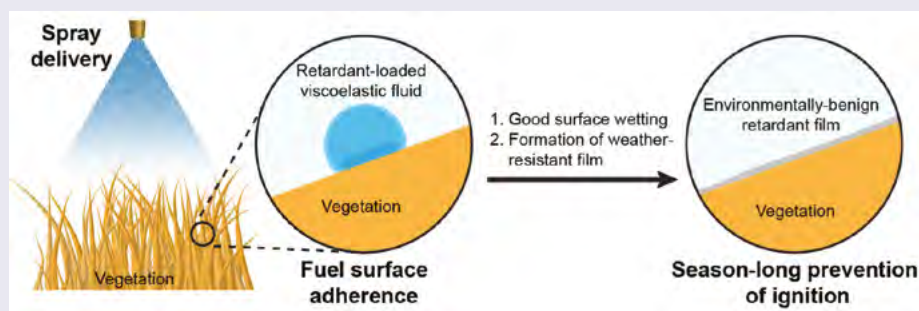
Our trials showed that high-rate APP2 treatments applied prior to a burn could be effective as a flame retardant in the short-term. But as Figure 1 shows, they lost their fire retardant effect over time.

**Figures 2a and 2b: Fire protection over time (in seconds) provided by the application of APP2 – with and without the hydrogel formulation at different rates (CL1, 2 & 3) – to slashed (a) and standing (b) dry grass**



Images courtesy Dr Eric Appel.

**Figure 3: Benefits of applying APP2 with the new hydrogel adjuvant**



Images courtesy Dr Eric Appel.

These preliminary results implied that, to be effective as on-farm fire inhibitors, flame retardants would need to be applied just prior to a fire or be applied to high-risk areas multiple times during the fire danger season.

But a breakthrough compound developed by a research team at the Supramolecular Biomaterials Laboratory of Stanford University in the US, led by Assistant Professor Eric Appel, appears to have the potential to increase the effective life of APP2 as a flame retardant in crop and stubble paddocks.

Eric and his team have developed an environmentally-benign viscoelastic 'hydrogel' carrier that improves APP2 coverage, rain-fastness and residual performance.

In field trials in California, application of APP2 – combined with the hydrogel formulation – to slashed and standing dry grass residue provided higher levels of protection for longer periods of time than application of APP2 without the hydrogel. (Figures 2a and 2b).

## Benefits of applying APP2 with the hydrogel adjuvant

- Maximises surface coverage by forming a film-like coating on the straw (fuel);
- Improves APP2 adherence to the straw, making it rain-fast for extended periods; and,
- Has the potential to provide season-long inhibition of ignition.

Coverage across the straw surface is important because the APP2 works like a mini molecular fire blanket that prevents oxygen getting to the surface of the straw in a fire (Figure 3). Any gap in the 'blanket' provides an opportunity for ignition.

The adherence and rain-fastness are also important because APP2 applied without the hydrogel is particularly vulnerable to washing off in rainfall and can flake off in hot and windy weather.

Wetters, oils and surfactants make a huge difference to the performance of most agri-chemicals and the combination of the new hydrogel and APP2 seems to follow that trend.

The key characteristics of the hydrogel suggest it could also improve the performance of other chemicals in other applications, such as spraying a foliar fungicide in winter. The hydrogel is also environmentally benign being formulated from odourless, non-toxic natural products and is used at low concentration (1.4 per cent of final volume).

## Licensing and commercialisation

The hydrogel technology has been licenced by the Stanford University team and the hydrogel formulation of APP2 is being commercialised by Ladera Tech as 'Fortify'.

According to Ladera Tech President and CEO Wes Bolsen, there is significant US interest in Fortify, which he describes as an aqueous formulation of APP2. In the US the product is being offered in 1000 litre shuttle packs such as those used for liquid fertilisers.



The new product is already being used in the US by a range of entities including utility companies, the military and the Californian Department of Forestry and Fire Protection. The product is used to pre-treat target areas with residual flame retardant as part of data-driven fire management plans for the protection of lives, assets and infrastructure.

Fortify will be distributed in Australia through AgriTrading Pty Ltd and SANTFA will trial the new formulation as soon as it arrives.

At present, Australia does not have an Australian or New Zealand standard for fire chemical effectiveness and in the absence of this, Australia has adopted the US Federal Qualified Products List (QPL). The QPL process for Fortify will be complete at the end of December and the product is expected to be listed in January 2020, making it ready for use in Australia.

In the context of a stubble-retention farming system it is not likely to be economical to apply Fortify at paddock scale across a farm unless the cost is less than the combined values of a range of potential benefits including biochar remaining after burning treated stubble, soil carbon sequestration, the nutrients from the AAP2 and reduction in insurance cost.

Given the current discussions in Australia about the future cost of fire insurance, the potential to use a flame retardant may be worth talking about with your insurance agent.

With or without a direct insurance benefit there may well be a role for the new product in reducing risk of fire losses by using it to establish fire-resistant areas around houses, hay sheds, machinery sheds, base stations, livestock enclosures and along driveways.

There would also appear to be merit in developing co-ordinated community or region-wide plans for the strategic annual use of residual flame retardants to, for example, treat the vegetation around a local oval that acts as the community's bushfire 'last resort.'

The cost of fighting fires and the destruction of lives and property from wild fire is now so huge that we must be proactive and use all the tools available.

But a flame retardant is not a cure-all and is only one tool in the toolbox. A good fire management plan will have multiple integrated components.

**Acknowledgement:**  
SANTFA's Flame Retardant Fertiliser project is supported by Natural Resources, Adelaide and Mt Lofty Ranges.

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Product enquiries: [agritrading.com.au](http://agritrading.com.au); [www.ladera.tech](http://www.ladera.tech)

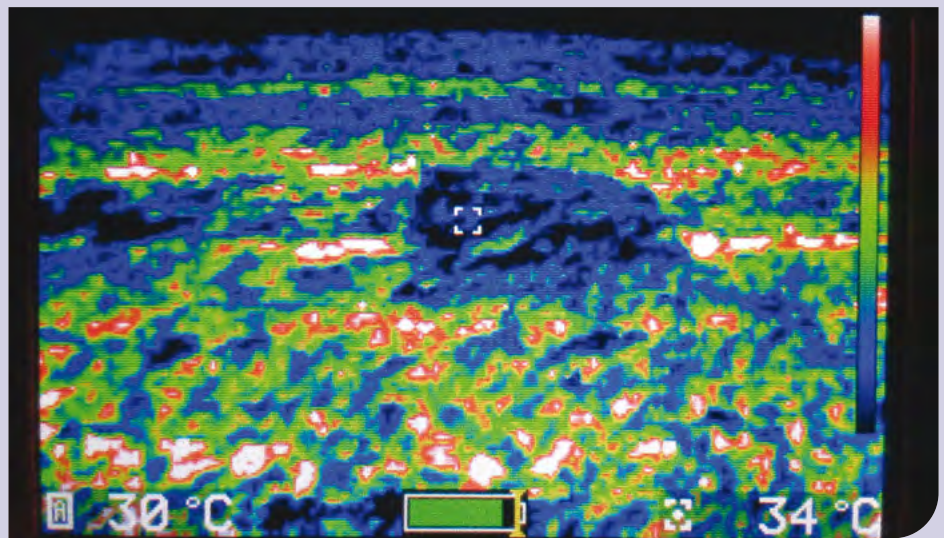
## Application and opportunities in Australia

The research breakthrough by the team at Stanford University has delivered an adjuvant that is a great partner for applying a flame retardant onto flammable biomass. The new technology offers a safe flame retardant that can be applied well in advance of a fire – and provide on-going residual protection for weeks and even months.

The standout benefits of this technology include the ability to strategically apply the retardant to prevent ignition and protect assets while freeing up vital resources during the actual fire.

### Some key technical points

- **Safety:** We don't see any toxicity issues with the adjuvant and the active ingredient breaks down to a common fertiliser.
- **Compliance:** We anticipate regulatory approval for the commercial use of Fortify in Australia in the first few months of 2020. Fortify is expected to be approved by the USDA and placed on their qualified products list in January 2020.
- **Cost Benefit:** We know the active ingredient works proportionally to application rate and coverage. This means it's possible to quantify the investment required to achieve a specific outcome in a specific scenario – we just need to map out and quantify those scenarios.
- **Carbon Sequestration:** If used at sub-optimum rates, a back burn or fuel reduction activity can be converted from an emissions producing event into a carbon sequestration



This infra red image shows the heat of the area treated with the fire retardant (blue) relative to the untreated areas (red) during the stubble burn.

event. Given the huge scale of fuel load reduction being proposed to manage future fire risk, dictating the destination of the carbon (to the soil rather than the atmosphere) could be an important consideration.

- **Local Formulation:** The finished product is 80 per cent water, so shipping individual 1000 litre shuttles on a standard pallet from the US is a cost worth eliminating. Initially co-operating through a multi-industry group allows for cost reduction by having a bulk batch formulated under licence in Australia. To that end, LaderaTech has signed an agreement with South Australian agricultural supply company, AgriTrading, to begin the rapid manufacturing and commercial sales of Fortify.

### An Australian users association

As more information about pre-emptive fire control has started to flow in the past couple of years, and the technology developed at Stanford has entered the early commercialisation stage – a potential Australian users association has formed organically.

The idea is to share independent trial results for pre-emptive flame retardant across industries, develop application ideas and to get the critical mass required for successful commercial adoption and local formulation.

The new preemptive formulation is all but ready for commercialisation in Australia.

# Ecologists address a burning question

■ By Dennis O'Brien, Agricultural Research Service – USDA

**W**HEN it comes to restoring rangeland habitats, there is no replacement for "prescribed fire," according to USDA Agricultural Research Service (ARS) ecologists.

Using fire with a stated objective – a strategy known as prescribed fire in the US – is widely recognised as an effective way to remove standing, dead vegetation on rangelands. But fear of fire has left some to wonder if mowing or close grazing confers the same benefits.

Lance Vermeire, an ecologist at the ARS Fort Keogh Livestock and Range Research Laboratory in Miles City, Montana, compared the benefits of mowing rangelands with setting them on fire to rid them of unwanted debris and reset their ecological balance. He found in a recent study that fire is better than mowing because it restores soil health and promotes growth of grass that is more nutritious for grazing cattle.

"The results show that mowing is not the same as fire and cannot replace it. Fire is unique," he says.

## Fire is an essential resource

Wildfires are a part of the natural cycle of growth and regeneration in many habitats and although all fire effects are not always positive, rangeland managers have used fire to control invasive weeds, enhance forage quality, increase plant diversity and maintain wildlife habitats.

The nation's rangelands are owned and managed by a patchwork of government agencies and private interests and some managers are reluctant to use fire, opting instead to mow or graze areas to get rid of unwanted plants, open habitats to sunlight and restore native grasses.

"If a rangeland needs to be revitalised, the question often being asked is, 'what tools will best accomplish that?'" Lance says.

The question is important because rangelands cover millions of hectares across the Great Plains of the western US and they're essential for grazing livestock and as wildlife habitat. Rangelands are also a major source of water supplies.

## Climate change concerns

Droughts and drier conditions brought on by climate change make it essential to carefully control any prescribed fire, Lance says. But the drier conditions also mean that there is more combustible material in many areas just waiting for a spark, which could be a good reason to consider prescribed fire to reduce unwanted debris, he says.

"Fires are going to happen, so isn't it better to control the conditions, and decide what you want burned, and when and where you want to burn it, rather than waiting for a wildfire to break out and burn unchecked," he says.

## Effects on soil, forage quality and plant growth

To compare mowing with fire, Lance mowed the grasses in experimental plots during the May growing season, set prescribed fires in others and left others as control plots. About two months later, he measured the amount of plant biomass in the plots, analysed the soils for nutrients and assessed the forage quality of the dominant grasses. A year later, he repeated the same measurements and assessments.

He found that while mowing offered some benefits, fire proved to be a better tool for releasing nutrients into the soil, increasing the total amounts of grass and producing grass with more of the nutrients essential for healthy cattle, such as nitrogen and phosphorus.

The study was partially funded by the U.S. Forest Service. The paper was published in *Rangeland Ecology and Management*. ■



A USDA-ARS crew burns a small plot using a ring firing technique at Fort Keogh in Miles City Montana. Research has shown that fire is better than mowing or grazing because it restores soil health and promotes better quality pasture growth.



# Cool heads required after a fire goes through the farm

■ By GRDC

## AT A GLANCE...

- Prioritise family and mental health.
- Clear the immediate area surrounding houses of any danger.
- Seal up houses to protect from dust and topsoil drift.
- Work constructively with insurance assessors to achieve the best outcome.
- Assess areas worst affected by drift and implement a plan accordingly.
- Ensure there is adequate preparation for seeding the following season.
- Growers impacted by the Yorketown fire on South Australia's lower Yorke Peninsula in November 2019 have had the opportunity to learn from the experiences of those affected by the Pinery fire in November 2015.
- Owen grower Ben Marshman, Hamley Bridge grower Adrian McCabe and Elders' agronomist Michael Brougham all shared their experiences following the Pinery fire at an information session organised by Weavers Ag Bureau.

**T**HE 2015 Pinery fire in South Australia's Mid North burnt more than 1400 hectares of the Marshmans' Owen district property and destroyed infrastructure including fences and sheds. At a recent bushfire information session organised by Weavers Ag Bureau, Ben Marshman, who farms with wife Bess and their four young children, shared a list of priorities he would manage differently if his property was ever affected by fire again.

This included:

- Family;
- Immediate environment surrounding the house;
- The house itself;
- Insurance;
- Drift control for the remainder of the property; and,
- Seeding.

## Spend time with the family

Ben says one of his biggest learnings following the 2015 Pinery fire was to prioritise mental health and spend time with family.

"It is easy to get overwhelmed with the job in front of you and think the entire clean-up needs to be done as soon as possible, but it doesn't," he says.

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**The 2015 Pinery (SA) fire burnt around 86,000 hectares in just six hours. Two lives were lost and 90 people hospitalised.**

"It is important to sit back, prioritise and make good, informed decisions.

"Talk to your family and those around you and don't make rash decisions.

"It might also be a good idea to keep alcohol consumption to a minimum. Most of us love a beer, but it is a testing time for the whole family and there is a lot of anxiety from the enormity of the event which can be exacerbated by alcohol.

"Look after your family and, if you can, get away from the fire zone. Rather than living in the fire zone and enduring it every day, try to get away to a shack or somewhere else and look after yourself and your family for a while."

### **Immediate environment surrounding the house**

Clearing the immediate area surrounding the house of any danger and debris as a result of the fire is one of the first steps in keeping the family safe, Ben says.

"For us, gutters were one of the first things we needed to address following the fire," he says.

"Making sure they were safe and clean while also tidying up any other immediate dangers was one of our first priorities.

"We also looked to minimise the risk of drift from bare paddocks surrounding the house. As well as cultivation, we sowed some spare wheat seed to help get some cover and minimise drift from those paddocks right next to the house."

### **Making the house safe**

According to Ben, sealing up the house to protect from sand and ash following the fire is important in ensuring family health.

"We were lucky enough to still have a house following the Pinery fire," he says.

"Sealing the house up as soon as possible is very important. Every door, window or gap... seal it up with duct tape, have one entrance point and put new seals on all those gaps to make sure they seal really well.

"The fine silica dust which blows around in the air after fire is not good for your health, especially if you have young children."

### **Insurance**

Taking the time to think about insurance needs with family and putting some effort into determining losses and their approximate values helps all parties involved in the insurance process, Ben says.

"Don't just rely on the insurance assessors to come out and do it for you," he says. "The assessors are people too and fires are tough on all parties, including them.

"Take the time to go over your insurance, work out what you lost and put some approximate figures on it for the assessors because if you help them, they will help you.

"It is also important to really familiarise yourself with your insurance policy because there will be a lot of things in it which you are entitled to which you might not have realised you were."

### **Drift control**

Ben says the immediate reaction of all farmers following the 2015 Pinery fire was to jump into it and act immediately to stop topsoil drifting.

But given his time again, Ben says he would take a different approach.

"If it were to happen again, I would have held off a little bit longer and assessed what was actually happening and where the worst patches were," he says.

"After a few days you can work out what ground is holding on and recovering, rather than going out and ripping everything up straight away. It is important to observe which paddocks are the worst and make a plan for what is happening rather than what might happen.

"We did a lot of cultivation following the fire, but from our experience with sandy soils it is better off leaving them if there is any sort of root system still there as that will hold the ground in place better than cultivation.

"When cultivating heavy ground, we were ripping to up to 20 cm deep to make sure we were bringing up decent sized clods of clay to stabilise the ground."

One of the biggest things Ben learned following the Pinery fire was to have every second or third tyne up out of the ground on the cultivator so there is the option to go back and cultivate the interrow if the need arises.

"We had some big rains following the fire which broke down the clods and everything started drifting again," Ben says.

"That's why I think it is important to cultivate with every second or third tyne up, as it gives you another option to go back and cultivate if it does rain and start drifting again."

### **Be ready for seeding**

Ben stresses the importance of not losing sight of the bigger picture and being ready for seeding in autumn the next year.

"As grain growers, seeding is our bread and butter," he says.

"After a fire it is easy to feel like you need to clean everything up straight away, but the reality is you don't.

"You still need to plant next year's crop on time in order to get the best results and have an income for your family. Keeping extra seed on-hand for re-sowing is another important consideration.

"It is extremely likely that some patches will need to be re-sown, particularly with canola," he says.

"We had to re-sow a lot of canola following the fire, so my advice would be that if you don't have to grow canola then plant a cereal in those patches which are prone to drift.

"What helped us to protect canola from sandblasting was sowing some wheat with it. We normally sow our canola on 38 cm row spacings, so we sowed wheat in the interrow to help protect it. Alternatively, they could be sown together.

"Once the wheat has done its job and the canola has established well, spray the wheat out straight away as part of your first grass spray, otherwise it will rob moisture."

**The GRDC has a number of resources available to help growers manage following fire.**

**The Technical Resource Manual for Farm Fire Recovery was developed by the South Australian Research and Development Institute in response to the Lower Eyre Peninsula "Black Tuesday" fire in January 2005 and is available for growers to access on the GRDC website.**

**The GRDC also published a number of articles following the 2015 Pinery fire with topics covering managing bare soils, the effect of fire on soil microbial populations and the use of pre-emergent herbicides on fire-affected soils.**

**More information: Ben Marshman, [ben.bess@bigpond.com](mailto:ben.bess@bigpond.com).**





## Could benchmarking help growers survive the next dry?

**F**INANCES rather than philosophy is agricultural benchmarking expert Simon Fritsch's speciality, but you could be mistaken for thinking otherwise when he describes the impact of the ongoing drought on farm bank accounts: "While we all lose in a drought, some lose less".

The Tamworth-based farm business consultant was a key speaker at the Grains Research and Development Corporation's (GRDC) *Dealing with the Dry* forums held in New South Wales and southern Queensland in recent months.

The forums were initiated to bring specialist advice direct to drought affected communities on topics such as agronomy, farm business, government support and debt management.

GRDC Grower Relations Manager – North, Susan McDonnell, said the forums, captured in a new GRDC video series were about delivering practical information and support to grain growers in drought affected regions during some of the toughest seasons on record.

"It was invaluable to have someone with Simon's expertise share his insights into how and why growers in different farming enterprises are faring better through this drought," Susan said.

"Understanding how aspects of your business, like expenses, compare with similar sized agricultural enterprises is important and can help identify how and where you might be able to reduce costs.

"How people structure their farming enterprises is very individual, but benchmarking really is an opportunity to learn

and compare your business with other similar operations in a constructive way."

She said Simon's presentation had been captured in a short video to ensure those growers who were unable to attend the GRDC *Dealing with the Dry* forums could potentially benefit from the information.

"Having a low-cost business is important and that is even more so in a drought," Simon said.

### Benchmarking to see where you sit

"Benchmarking is one way to identify where your business sits in terms of expenses and income. There can be large differences between the top performers and other similar size businesses.

"The reality is while we all lose in a drought, some lose less."

In example, Simon said some top performing growers in drought areas had annual losses of minus one per cent return on



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Simon Fritsch says while we all lose in a drought, some lose more than others.



# Pigeonpea needs integrated weed management

**P**IGEONPEA might not be well known in Australia, but there are more than a billion people in Asia and Africa who eat this dried grain legume in a variety of dishes, and global demand is high.

This demand is driving renewed interest in the crop, which was introduced to Australia in the 1970s but never developed into commercial production. In fact, it has only been grown as a trap-crop to monitor the incidence of *Helicoverpa armigera* (pod borer or bollworm) in Bt cotton crops.

As an emerging crop of importance to the grains and livestock industries, researchers have begun the task of investigating the agronomic requirements of pigeonpea in the Australian environment. Leading the way on the weed management front are researchers Gulshan Mahajan, Rao C. N. Rachaputi and Bhagirath Chauhan from the Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland at Gatton.

"Pigeonpea is of interest because it is a drought and heat-tolerant summer legume, and provides both grain for human consumption and high quality fodder for livestock," says Bhagirath. "Its slow growth habit is a significant limitation, making the crop very susceptible to yield loss as a consequence of competition from weeds."

In the summers of 2017 and 2018 the researchers tested the effect of row spacing and herbicide applications on crop yield. Their findings suggested that narrow row spacing (25 cm) and sequential herbicide applications provided effective weed control that preserved yield in pigeonpea.

Across the two years there was a marked difference in seasonal conditions and weed flora. In 2017, the only weed present at the site was giant pigweed but following a deep



**Narrow row spacing (25 cm) and sequential herbicide applications provides effective weed control that preserves yield in pigeonpea.**

**Good drought managers know their local environments well and can make good strategic decisions as a result of that information.**

assets managed (ROAM) in 2018–19, while others in the same region experienced losses of minus seven per cent ROAM.

"On a \$10 million asset, that's a \$600,000 difference a year. If that rate of loss continues for three to four years, it becomes a very significant difference in wealth erosion between those managing their costs well and those who are not."

He said regaining control of business expenditure – at any time, regardless of the season – hinged on understanding your production costs and having a clear, business plan.

"Having a farm business plan shows very clearly that you are in the driver's seat. You cannot control everything, but a logical plan articulates to your financier, and the people around you, that you have thought through the issues and are making informed decisions," Simon said.

"This plan is critical when it comes to things like employees and can help with decision-making on things such as, accrued leave or whether you can afford to tackle low cost, on-farm jobs.

"It is important to have a plan around your staff. What projects can you do that might not cost a lot but might prepare the business to take advantage of the next opportunity when the season breaks?"

Simon said the grain industry's top performers were also able to take a strategic view of their business.

## Know what your local environment can deliver

"This may mean ascertaining that you live in an environment where it doesn't rain at least one in every five years. What you do with that information makes the big difference," he said.

"For example, at Bellata (in northern NSW) the soil may hold 200 mm of plant available water and it's a 500 mm rainfall zone. At 25 per cent rainfall it will take more than 18 months to fill a profile. You can use that information to build a resilient business and a farming system that can capture the upside, but also take away some of the downside.

"That could mean introducing a long fallow in response to lower-than-average rainfall so that moisture in the profile is stored."

When it came to developing and enacting a farm business plan, Simon said it was critical to surround yourself with experienced specialists to support your decision-making.

"Have a good team of people around you, including your banker, accountant and agronomist or farm consultant and make sure your plan is viable and sensible and that you are held accountable to it," he said.

The GRDC has a dedicated web page <https://bit.ly/34FyU7p> to provide access to the latest research data and practical agronomic advice to assist with on-farm decision making during tough times.

The Dealing with the Dry page provides easy access to information on the economic, agronomic, farming systems and practical information on nutrient removal, ground cover, weed management and other impacts.



tillage operation there was a more complex community of weeds, particularly grasses, growing at the trial site in 2018.

"At the narrow (25 cm) and wide (50 cm) row configuration, a single application of the pre-emergent (pendimethalin) or a sequential application of pre-emergent and post-emergent (imazapic) herbicide reduced weed biomass and increased yield, compared to the no-control treatment," he says. "When the sequential herbicide program was applied, it was equally effective in the narrow, wide and paired row configurations, giving growers more flexibility."

"In seasons where conditions are too dry for the pre-emergent herbicide to be effective and there is a heavier reliance on the post-emergent herbicide alone – or where there are multiple weeds present – having the crop sown on narrower rows provides better weed control and preserves crop yield."

In the right conditions, the sequential use of herbicides addresses the common problem of multiple flushes of weeds over summer.

For more information about integrated weed control visit the WeedSmart website: [www.weedsmart.org.au](http://www.weedsmart.org.au)

Attribution: Cindy Benjamin, WeedSmart.



This trial used paired row sowing (right) to give pigeonpea a competitive advantage over weeds compared to sowing in a wider configuration (50 cm, left).

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## ASK AN EXPERT – WHAT'S HAPPENING IN WEED DETECTION AND SITE-SPECIFIC CONTROL?

■ With Greg Condon, AHRI and WeedSmart Agronomist

**T**HE power of the WeedSmart Big 6 really ramps up when the tactics are applied in a site-specific way. The broad-brush approach of herbicide application has played a big role in the development of herbicide resistance and has effectively changed the weed spectrum on many farms in favour of weeds that are hard-to-kill using least-cost herbicide options.

Greg Condon, Australian Herbicide Resistance Initiative (AHRI) and WeedSmart agronomist based at Junee, NSW has seen the benefits that growers have won through the use of optical sprayer technology over the past 20 years and is keen to see the development of new technologies that will be commercially available in the foreseeable future.

"Being able to identify weeds and apply a treatment that is going to be the most effective is the best way forward," he says. "If the treatment applied kills the weed and prevents seed set then eradication of the weed – herbicide resistant or not – is within reach."

Once the location of the weeds is known it is possible to use robust herbicide rates and devise mixtures that are most effective on the weeds present, knowing that the volume of product applied will be low and therefore an economical proposition.

"The mapping technologies are developing fast and many are already commercially available," says Greg. "In some cases, satellite imagery is useful to identify weedy areas and to estimate areas and in other cases, drone imagery is more useful. The NDVI sensors mounted on tractors can also provide good information about the presence and density of weeds."

The site-specific weed control technology arena is pretty crowded at the moment with many companies and research bodies working hard to find the ultimate commercial products,



**Using a drone to collect the imagery is a practical option that offers more flexibility but the images collected need to be stitched together to create a single image for analysis.**

but it won't be long before there are paddock-ready options available to growers for both herbicide and non-herbicide control tools. Many of the leading ag-tech companies gave updates of their products and services at the 2019 WeedSmart Week events at Horsham and Emerald.

### What's the best way to identify and map weeds or weedy patches?

**Short answer:** Satellite or drone imagery.

**Longer answer:** Satellite imagery gives a broad view of the weeds present in a paddock, particularly in a fallow situation. Recent personal experience showed that ground truthing satellite maps using NDVI filters was not very successful.

Using a drone to collect the imagery is a practical option that offers more flexibility but the images collected need to be stitched together to create a single image for analysis. Some growers are effectively using their own systems but there is also a commercial option through providers such as Jerome Leray at In-Farm.

Getting accurate maps that can turn your current sprayer into a spot-sprayer is the closest-to-reality technology in site-specific weed control. When combined with the rapidly moving development of software to identify individual weed species, growers expect to achieve significant reductions in product volumes and take advantage of more expensive but effective selective herbicides.

### What are the herbicide delivery platforms closest to commercial operation?

**Short answer:** Robots and automated tractors are now giving a new angle to older technologies and artificial intelligence software is rapidly developing to support integrated herbicide sprayers.

**Longer answer:** Using an automated tractor or a robot, such



**Greg Condon, Australian Herbicide Resistance Initiative (AHRI) and WeedSmart agronomist based at Junee, NSW has seen the benefits that growers have won through the use of optical sprayer technology over the past 20 years and is keen to see the development of new technologies that will be commercially available in the foreseeable future.**





**The WeedChipper uses sensors to detect weeds and activate a tyne that can dig out large plants or weeds that are difficult to kill using current herbicides.**

as a SwarmBot, to expand the use of optical sprayer technologies opens up the possibility of spraying more often and continually targeting small weeds. These platforms could also adapt to new technologies as they are developed.

The reliability and practicality of green-on-green spraying is still a little way off but there is significant investment going on with ag-tech companies such as Bilberry and AgriFac teaming up to build a sprayer with wide-ranging capabilities.

While the green-on-green technology is a not yet widely or economically available, an interim option is a camera-guided shielded-sprayer. Being camera-guided, sprayers like CropStalker can operate in crops like lentils that do not have the plant architecture to allow the use of conventional trailing shields. These sprayers currently apply a band of herbicide so they are not weed-detecting, but they are still able to target weeds growing in-crop and using lower volumes or more selective herbicides. There is a possibility that these sprayers could also have cameras fitted to spray only when weeds are present.

And the 'old' optical spot sprayers are also updating. For example, WeedSeeker 2 now has on-board weed mapping

capability while WEEDit have upgraded their sensor accuracy and capability to analyse data. On-board mapping capability allows the sprayer to 'remember' where weeds were sprayed early in the fallow, enabling the operator to apply residuals to known weedy patches while also applying a knock-down to kill existing plants prior to planting.

### **What about delivering non-herbicide options?**

**Short answer:** Although there are a few non-herbicide tools being developed, most are likely to take a while to come to market.

**Longer answer:** The problem with many non-herbicide options, such as microwave and laser, has been that they are high energy when applied in a broad band, but the energy required is cut by over 90 per cent when applied in a site-specific way.

SwarmFarm have demonstrated the possibilities of microwave units on a robotic platform that also allows for the time required to deliver the necessary treatment.

The WeedChipper is another option that uses sensors to detect weeds and activate a tyne to physically remove weeds. Once developed, this tool has great application in situations where escapes have developed into large plants where herbicide is not the best option, or to manage weeds that are difficult to kill using current herbicides.

An overseas camera-guided cultivator, like the camera guided shielded sprayer, is also available and suitable for reducing weed pressure in-crop. ■



**While the green-on-green technology is a not yet widely or economically available, an interim option is a camera-guided shielded-sprayer like CropStalker.**

## **HOW TO ASK A WEEDSMART QUESTION**

Ask your questions about site-specific weed control on the WeedSmart Innovations Facebook page WeedSmartAU, Twitter @WeedSmartAU or the WeedSmart website <https://weedsmart.org.au/category/ask-an-expert/>

'WeedSmart' is an industry-led initiative that aims to enhance on-farm practices and promote the long term, sustainable use of herbicides in Australian agriculture.

# New dual fungicide resistance in barley disease has been confirmed

**A**USTRALIAN researchers have confirmed a new form of dual fungicide resistance in the common barley disease, net form net blotch (NFNB).

They have identified a new genotype in NFNB that is – for the first time known – showing dual resistance to both a succinate dehydrogenase inhibitor (SDHI) fungicide as well as some DeMethylation Inhibitor (DMI) fungicides.

The discovery was outlined at the 2019 Crop Protection Forum at Moama in New South Wales and the national fungicide resistance workshop in Melbourne.

Working together to test barley samples collected near Minlaton on South Australia's Yorke Peninsula, researchers from the South Australian Research and Development Institute (SARDI), the research division of Primary Industries and Regions SA, and the Centre for Crop and Disease Management (CCDM) found fungal strains showing reduced fungicide sensitivity to SDHI fungicide fluxapyroxad.

The samples were identified by SARDI plant pathologists Tara Garrard and Hugh Wallwork and confirmed as resistant via tests conducted by CCDM's fungicide resistance team led by Fran Lopez-Ruiz.

"The samples, collected from two paddocks a short distance apart, clearly showed high NFNB disease levels when the SARDI team was first alerted to the problem by agronomist Sam Holmes," said Hugh.

Additional testing by the CCDM team then confirmed the higher levels of resistance correlated with a genetic mutation in the Sdh complex which is the NFNB target of SDHI fungicides.

Following these initial tests more detailed studies were undertaken, reinforcing the discovery of resistance.

"While the type of SDHI resistance and the mutations found in the Yorke Peninsula isolates have been recorded previously in Europe, this is the first confirmation of this genotype in Australia," said Fran.

Hugh said the samples were from the barley variety Spartacus CL, grown in a barley-on-barley rotation with fluxapyroxad used in both years. In terms of fungicide application, soil moisture in the area was considered to be adequate to allow for good uptake and further testing on residual seed clearly showed that the efficacy was greatly reduced.

Additional samples collected at the site also showed resistance to the Group 3 DMI fungicide tebuconazole, and although the resistance mechanism is still being investigated, Fran said it was known to be different to the DMI resistance mechanisms already reported in barley net blotches in Western Australia.

## Supporting some of the world's best researchers

GRDC diseases manager, Friday Obanor, said the discovery of these new genotypes reflected the importance of research and development in the Australian grains industry and investment in research conducted by both the CCDM (co-supported by Curtin University and the GRDC) and SARDI.

"Australia has some of the best crop disease experts in the world working here and their efforts are critical for identifying and quantifying new risks to agriculture in a rapid and highly co-ordinated way," said Friday.



CCDM fungicide resistance team leader Fran Lopez-Ruiz (left) and team member Wesley Mair. (PHOTO: CCDM)





The fungicide resistant samples from Yorke Peninsula were identified by SARDI plant pathologists Tara Garrard and Hugh Wallwork. (Photo: GRDC)

"The faster we can alert growers, the quicker we can get management strategies into the paddock."

The Yorke Peninsula results are a reminder for growers to consider using different modes of action when applying fungicides, as continuous use of the same fungicides will increase selection pressure further, increasing the risk of even more rises in resistance levels.

This also applies to the closely related spot form net blotch disease which has already developed high levels of resistance to some DMIs in WA.

### Integrated resistance management

Fran said the results also reinforced the need for growers and advisers to implement a fungicide resistance management strategy that encompasses an integrated approach, involving:

- Avoid growing barley on barley – look for suitable alternative break crops;
- Choose fungicide mixtures with different modes of action (if available);
- Do not use Group 7 fungicides for net blotch control in the areas where resistance to this group of fungicides has been reported;
- Group 7 fungicides (seed dressing and foliar) should not be used more than once per season in any crop rotation – alternate them instead with other fungicides with different modes of action;
- Do not apply the same Group 3 fungicides twice in a row – look at alternate sprays;
- Avoid using tebuconazole, propiconazole and epoxiconazole as a stand-alone product in barley for any disease as a way of avoiding indirect fungicide resistance selection;
- Use fungicides as early as possible after symptoms develop if conditions are highly conducive for disease development; and,
- Do not spray below label rates to avoid fungicide underperformance.

Growers on Yorke Peninsula, south of Port Wakefield and Kadina, should avoid using any SDHI fungicides for the control of NFNB on barley during 2020. This will help to contain the further development of resistance and hopefully allow for the return of SDHI use in the region at a later date

## \$2.4 million seed processing plant

PACIFIC Seeds' state-of-the-art seed processing plant is officially ready for business and is expected to significantly improve the quality and quantity of future seed production in Australia.

The \$2.4 million custom-built facility was officially unveiled in early December last year at an event attended by UPL Limited CEO Jai Shroff, Advanta Seeds Group CEO Bhupen Dubey and Toowoomba Mayor Paul Antonio.

Pacific Seeds Managing Director Barry Croker welcomed guests to the event and remarked on the considerable contribution that the new processing plant made to the region and to the industry.

"The new processing plant is not only a major addition to Toowoomba's industrial sector, but a representation of Pacific Seeds' commitment to Australian agriculture," Barry said.

"We are proud to be investing into the agricultural sector through research and innovation and this new plant marks a significant component of our plans to expand our technical development capabilities."

The plant is expected to increase seed processing capacity by 30 per cent while improving seed cleaning and treatment across a wide range of crops, delivering new levels of market availability and assurance for Australia farmers.

"We designed the plant for maximum flexibility so that our output quality and efficiency ensured a consistently high-grade product for our customers.

"One of the technological highlights of the new plant includes precision colour sorting capabilities, which processes individual kernel images and incorporates size and shape recognition technology as a standard feature.

"This project was a culmination of international and local input, we worked hand-in-hand with German-based firm Petkus Technologies and GrainTech Engineering who were the leading equipment designers and suppliers," Barry said.

"A number of local subcontractors were also instrumental in ensuring the success of this project, including QA Electrical and Pulford Air and Gas.

"Collectively, this new plant will present significant benefits to the region, our customers, the company and our growers."



Neil Comben, Pacific Seeds, and Bruce Vandersee, Vanderfield at the December opening of the state-of-the-art seed processing plant.

# GRDC offers a helping hand to graduate agronomists

**A**s a graduate agronomist, it's easy to be daunted by the prospect of sourcing and interpreting a wealth of research information, establishing a professional reputation or having a difficult conversation with a client.

But there are few challenges that can't be overcome by time, hard work, honesty, earnestness and a willingness to learn.

Those wise words were some of the sage advice offered to a group of young agronomists at Capella in Central Queensland recently as part of the Grains Research and Development Corporation (GRDC) initiative aimed at boosting the capability and capacity of graduate agronomists.

The initiative aims to provide critical 'soft skill' development, link graduates with relevant research resources and offer insights into how experienced advisers handle challenging situations and seasons.

Speaking during the event, respected Emerald-based agricultural consultant and GRDC northern panel member Graham Spackman, highlighted some key qualities that could assist with skill and career development.

"It's important to educate and train yourself by attending events like GRDC Updates, training courses, workshops and field days. Make a habit of attending and keeping up-to-date," Graham said.

"It's also well worth joining relevant professional organisations

to extend contact networks and further your knowledge, not just in a technical capacity but also for general business skills and personal development.

"Focus on developing relationships by spending time with clients on-farm, with other agronomists and also researchers – if there's an opportunity to assist with trial work and data collection, jump at it.

## Go the extra mile

"At the end of the day it's important to develop a professional reputation by going the extra mile. Study the available science, do the hard yards, communicate well, be reliable and be willing to learn.

"Establishing trust and credibility takes time but it can be helped along by doing what you say, not just saying what you'll do."

GRDC Senior Regional Manager North Gillian Meppem said GRDC was committed to supporting capacity in the Australian grains industry, particularly for those entering the industry, through the provision of information resources, facilitating contact networks and offering mentoring opportunities.

"Agronomists and advisers provide an invaluable practical conduit between the scientific community and growers by communicating up-to-date research information and encouraging adoption of the latest agronomic management recommendations. Newly graduated agronomists are the future of our industry and the GRDC is keen to support this group through the early years of their careers," Gillian said.

"The Capella event was the first in a series of networking events where graduate level agronomists can engage with more experienced advisers to talk about their emerging careers, the challenges they may face and learn more about the GRDC's wide array of resources which detail scientifically robust and validated industry research.

"The Boosting the capability and capacity of graduate agronomists investment is one way GRDC can support their professional development and, in turn, contribute to the future productivity and profitability of the Australian grains industry. These events also provide an opportunity for experienced agronomists and advisers to give back to the industry in a practical way by sharing their experiences, tips and tricks with the emerging crop of young professionals."

## Upcoming events

A number of similar events are planned for 2020 in conjunction with the GRDC Grains Research Updates on:

- February 18 and 19 – Wagga Wagga, NSW.
- February 25 and 26 – Dubbo, NSW.
- March 3 and 4 – Goondiwindi, QLD.
- March 10 – Barellan, NSW.

The two-hour, free events will include a short presentation on topics such as difficult conversations and conflict management or negotiation, followed by a Q&A panel session with experienced agronomists or advisers and then networking opportunities.

If you are a graduate agronomist wanting to attend one of these events, or you are an established agronomist who has experience and knowledge you'd like to share, the GRDC would value your involvement in this program. For more information please email [rachelb@seedbedmedia.com.au](mailto:rachelb@seedbedmedia.com.au)



GRDC Senior Regional Manager North Gillian Meppem with Central Highlands agronomist Meg McCosker, Spackman Iker Ag Consulting, Emerald.



## Deep soil test to avoid delving into 'dirt nightmare'

**D**ELVING or mixing a clay-based subsoil into a sandy topsoil is a practice that has benefited many grain growers in Western Australia, but does the same approach yield results for lighter soils in other areas such as southern NSW?

While there has been limited, validated research into the value of the practice in the region, well respected Riverine Plains Inc research officer and independent soil scientist Cassandra Scheffe,

is advising growers to exercise 'extreme caution' and do their groundwork before undertaking any delving treatments.

"There has been very little trial work into delving and clay spreading in southern NSW, primarily because this area has very localised sandy rises with a claypan underneath, rather than large problem areas," Cassandra said.

"But in the past two years, a few growers across the region have undertaken delving treatments with positive results and this has generated significant local interest.

"Now we have growers looking at their land thinking 'if delving is going to benefit this small area of sandy soil, maybe it will be good for the whole paddock'.



Cassandra Scheffe encourages growers to be cautious if considering delving treatments.



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"But the very real concern is delving areas without understanding the subsoil constraints and mixing problem clay with their topsoil, which could create serious and irreversible problems in the paddock."

Cassandra said in WA where the practice of delving and clay spreading was widespread, growers were working with large areas of deep sands, but the soil types were significantly different in southern NSW.

### Caution! Delving is irreversible

"Delving and clay spreading in the wrong situation scares me because it is so irreversible and it could well become a dirt nightmare for the grower involved," she said.

"Before growers or farm advisers consider this type of treatment, they absolutely need to know what is underneath the surface."

Cassandra said there were incredibly varied soil types across the Riverina.

"Even within paddocks, there are major variations – for example in one 50 hectare paddock there might be three or four different soil types," she said.

"Before you start digging up areas of your paddock, dig a hole and find out what is down there and get it tested."

"If you don't, you could end up mixing sodic, saline or acidic clay with your topsoil or sand; bringing sodic clay to the surface can reduce water infiltration and inhibit germination while delving too deep can cause erosion."

### Local grower experience

Adopting a strategic approach to this form of soil treatment is an approach supported by Riverina growers David and Sharon Fisher.

The Fishers began delving and clay spreading on their lighter, sandy soils two years ago, motivated by a neighbour's success and awareness of successful clay delving in other regions.

"We started delving purely as a trial. We were unsure it would deliver results given our soil type and the fact we were only doing strategic treatments on sandy areas," David said.

"But the transformation was incredible. Even with the limited rainfall last year, in the areas we had treated our wheat yields were 1.6 tonnes per hectare compared with untreated control areas which went 300–600 kgs per hectare."

The improvements were so dramatic the Fishers invested in their own delving equipment with a plan to continue treatments on selected areas of their 1800 hectare operation at Rennie.

"We have significant variation across individual paddocks so ultimately we are looking at potentially doing 25 to 50 per cent of each paddock, depending on the results of deep soil tests combined with satellite maps and harvest yield data," David said.

"Before we began, we did soil tests at a depth of 1.2 metres and used the satellite and yield maps to determine the exact areas we needed to treat."

"Last year some of these treated areas yielded more than our better country, possibly because the crop could utilise retained nutrients and stored moisture at depth as a result of the work."

"So, our decision to invest in delving equipment came with risks, but we wanted to be able to continue to improve our paddocks and we felt our decision was supported by our significant yield increases."

David said the cost of delving at a contract rate worked out at approximately \$400 per hectare, but in their case the treatment 'will pay for itself' as a result of subsequent yield improvements.

### Do the soil tests and be targeted

"My advice to other growers contemplating delving would be to do the soil tests and determine where exactly the work is going to be done, so the treatments are targeted," he said.

"It is too expensive to go ahead and do the work without considering where and why you are doing it."

His advice matches the recommendations of Cassandra, who said it was important growers considered the following actions before undertaking delving and clay spreading work:

- Soil test to depth – at least one metre – and beyond the depth of any delving equipment.
- Conduct an electromagnetic mapping (EM) survey (which provides detail on variability in soil properties across the paddock, which may be due to changes in soil texture, moisture, cation exchange capacity, bulk density and/or salinity).
- Dig a soil pit.
- Define the area to be treated.

For more information on clay spreading and delving in light, sandy soils go to <https://bit.ly/2QxGDAe>

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# the gate



# New dual fungicide resistance in barley disease has been confirmed

**A**USTRALIAN researchers have confirmed a new form of dual fungicide resistance in the common barley disease, net form net blotch (NFNB).

They have identified a new genotype in NFNB that is – for the first time known – showing dual resistance to both a succinate dehydrogenase inhibitor (SDHI) fungicide as well as some DeMethylation Inhibitor (DMI) fungicides.

The discovery was outlined at the 2019 Crop Protection Forum at Moama in New South Wales and the national fungicide resistance workshop in Melbourne.

Working together to test barley samples collected near Minlaton on South Australia's Yorke Peninsula, researchers from the South Australian Research and Development Institute (SARDI), the research division of Primary Industries and Regions SA, and the Centre for Crop and Disease Management (CCDM) found fungal strains showing reduced fungicide sensitivity to SDHI fungicide fluxapyroxad.

The samples were identified by SARDI plant pathologists Tara Garrard and Hugh Wallwork and confirmed as resistant via tests conducted by CCDM's fungicide resistance team led by Fran Lopez-Ruiz.

"The samples, collected from two paddocks a short distance apart, clearly showed high NFNB disease levels when the SARDI team was first alerted to the problem by agronomist Sam Holmes," said Hugh.



CCDM fungicide resistance team leader Fran Lopez-Ruiz (left) and team member Wesley Mair. (PHOTO: CCDM)

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**The fungicide resistant samples from Yorke Peninsula were identified by SARDI plant pathologists Tara Garrard and Hugh Wallwork. (Photo: GRDC)**

Additional testing by the CCDM team then confirmed the higher levels of resistance correlated with a genetic mutation in the Sdh complex which is the NFNB target of SDHI fungicides.

Following these initial tests more detailed studies were undertaken, reinforcing the discovery of resistance.

"While the type of SDHI resistance and the mutations found in the Yorke Peninsula isolates have been recorded previously in Europe, this is the first confirmation of this genotype in Australia," said Fran.

Hugh said the samples were from the barley variety Spartacus CL, grown in a barley-on-barley rotation with fluxapyroxad used in both years. In terms of fungicide application, soil moisture in the area was considered to be adequate to allow for good uptake and further testing on residual seed clearly showed that the efficacy was greatly reduced.

Additional samples collected at the site also showed resistance to the Group 3 DMI fungicide tebuconazole, and although the resistance mechanism is still being investigated, Fran said it was known to be different to the DMI resistance mechanisms already reported in barley net blotches in Western Australia.

### **Supporting some of the world's best researchers**

Grains Research and Development Corporation (GRDC) diseases manager, Friday Obanor, said the discovery of these new genotypes reflected the importance of research and development in the Australian grains industry and investment in research conducted by both the CCDM (co-supported by Curtin University and the GRDC) and SARDI.

"Australia has some of the best crop disease experts in the world working here and their efforts are critical for identifying and quantifying new risks to agriculture in a rapid and highly co-ordinated way," said Friday.

"The faster we can alert growers, the quicker we can get management strategies into the paddock."

The Yorke Peninsula results are a reminder for growers to consider using different modes of action when applying fungicides, as continuous use of the same fungicides will increase

selection pressure further, increasing the risk of even more rises in resistance levels.

This also applies to the closely related spot form net blotch disease which has already developed high levels of resistance to some DMIs in WA.

### **Integrated resistance management**

Fran said the results also reinforced the need for growers and advisers to implement a fungicide resistance management strategy that encompasses an integrated approach, involving:

- Avoid growing barley on barley – look for suitable alternative break crops;
- Choose fungicide mixtures with different modes of action (if available);
- Do not use Group 7 fungicides for net blotch control in the areas where resistance to this group of fungicides has been reported;
- Group 7 fungicides (seed dressing and foliar) should not be used more than once per season in any crop rotation – alternate them instead with other fungicides with different modes of action;
- Do not apply the same Group 3 fungicides twice in a row – look at alternate sprays;
- Avoid using tebuconazole, propiconazole and epoxiconazole as a stand-alone product in barley for any disease as a way of avoiding indirect fungicide resistance selection;
- Use fungicides as early as possible after symptoms develop if conditions are highly conducive for disease development; and,
- Do not spray below label rates to avoid fungicide underperformance.

Growers on Yorke Peninsula, south of Port Wakefield and Kadina, should avoid using any SDHI fungicides for the control of NFNB on barley during 2020. This will help to contain the further development of resistance and hopefully allow for the return of SDHI use in the region at a later date.

**Growers and agronomists in South Australia are urged to send NFNB stubble samples to SARDI or CCDM for their analysis to determine whether resistance to SDHI and DMI fungicides is also present in other regions of SA.** ■





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# Taking a bigger slice of the Asian cake and biscuit market

**A** REINVIGORATED Australian soft wheat industry could potentially take a larger slice of Asia's growing cake and biscuit market, according to an Australian Export Grains Innovation Centre investigation.

The amount of wheat grown in Australia specifically for cakes and biscuits has declined over the past decade and is largely used by the domestic market.

AEGIC found that Australian Soft (ASFT) wheat – and potentially low protein Australian Noodle Wheat (ANW2) – could be suited to some sweet Asian products, a potentially lucrative market.

AEGIC General Manager – Research & Technical Services Dr Ken Quail, said the premium cake and biscuit market across Asia was growing strongly.

"The increasing demand means flour millers are open to using Australian wheat, if the quality and price is right," he said.

Ken said the project involved working closely with flour millers in Indonesia and Japan to assess the baking performance of Australian Soft (ASFT) wheat varieties, as well as low-protein Australian Noodle Wheat (ANW2) varieties.

He said ANW2 may be a short-to-medium term opportunity.

"ANW2 is semi-soft, low-protein noodle wheat that falls outside the main grade requirements for premium Japanese noodles," he said.

"Our research suggests that ANW2 could be used in some

## SOFT WHEAT CLASSES...

**ASFT:** Australian Soft (ASFT) is Australia's cake and biscuit wheat class. Wheat varieties in this class are soft grained, with low protein. Production is generally used domestically for biscuits and cakes.

**ANW2:** Australian Noodle Wheat (ANW) is grown in Western Australia, principally for the premium Japanese udon noodle market, which has strict quality standards. When the grade requirements of ANW are not met, the grain cascades down into ANW2 at a discount. This can result in quantities of ANW2 being available with limited market outlets. Establishing new markets for ANW2 could reduce the risk to ANW growers and expand demand.

cake or biscuit products in Asia. This would be a new market, potentially reducing risk for noodle wheat growers and expanding demand.

"It's important to note that ANW2 would only be a partial solution as production is relatively limited."

Ken said building significant soft wheat exports to Asia, and in particular Indonesia, would be a longer-term prospect for Australia.

"This would require a coordinated, long-term effort to breed new soft wheat varieties with not only improved cake and biscuit performance, but also more attractive agronomic qualities for growers," he said.

"Thanks to this research, we now have a clearer understanding of Asian market requirements for soft wheat products. This will allow the Australian industry to examine the potential for increasing Australian soft wheat exports."

This research was partially supported by GRDC and involved collaboration with Indonesian and Japanese flour millers, and the Australian industry including InterGrain, LongReach, Stirlings to Coast Farmers, CBH, Premium Grain Handlers, Allied Pinnacle and Mr Tony Guinness.

AEGIC is an initiative of the Western Australian State Government and Australia's Grains Research and Development Corporation.



AEGIC's Dr Ken Quail (centre) and Daniel Li (left) working with Indonesian flour millers to trial Australian wheat for cakes and biscuits



AEGIC Senior Research Scientist Dr Siem Siah led the project.



# Brown rice variety packs antioxidant punch

■ By Jan Suszkiw, Agricultural Research Service – USDA

**G**EDREW is a brown rice with an odd kernel trait that sidelined its commercial prospects. Now, Agricultural Research Service scientists' re-examination of the trait and its link to increased antioxidant levels could give the rice variety a new commercial lease on life.

GEDrew is the result of a mutagenesis rice breeding program conducted more than a decade ago by rice geneticist Neil Rutger (retired) at the ARS Dale Bumpers National Rice Research Center in Stuttgart, Arkansas. The variety, a genetic mutant, didn't make the cut, however, and Neil placed it in storage in the USDA-ARS World Rice Collection, a repository of more than 19,000 accessions and 12 species representing the genus *Oryza*.

And there GEDrew might have remained today, were it not for the follow-up investigations of ARS chemist Ming-Hsuan Chen and the centre's current director, Anna McClung.

In 2007, they began re-evaluating the collection's specialty rice accessions for traits that could contribute to improved grain yield or nutritional content. These gene banks, serve as a critical source of diversity in the face of emerging pest and disease threats, environmental change, market demands and other events.

Their investigation of GEDrew focused on a single gene mutation that results in kernels with enlarged, or 'giant,' embryos. In addition to a higher proportion of bran to whole-kernel weight, the researchers observed, the giant embryo trait also correlated to a three-fold increase in alpha-tocopherol and a 20- and 29-per cent increase in total tocotrienols and gamma-oryzanol, respectively.

## Important biological activity in the human body

Tocopherols and tocotrienols are forms of vitamin E with important biological activity in the human body. These may include helping prevent unstable molecules called free radicals from causing cellular damage and other associated harm, Chen said. Gamma-oryzanol, a mixture of antioxidant compounds in the bran's oil fraction, is thought to play role in reducing blood cholesterol levels, among other health-promoting benefits, she added.

Grain yield evaluations showed that GEDrew compared well to Drew and Cocodrie, two commercial varieties the researchers used for comparison in Texas and Arkansas trials.

Even though GEDrew produced slightly smaller grains, it was unmatched in terms of its yield of bran, lipids and the three antioxidants.

All are high-value ingredients for specialty uses ranging from edible oil for cooking and salad dressings, to breakfast cereals, nutrition bars, beverages and skin-care products, according to Anna McClung.

She credits the rice mutation breeding efforts of Neil Rutger – a 2009 ARS Hall of Fame inductee – with setting the stage for their finding that the giant embryo trait leads to whole grain with increased gamma-oryzanol levels and vitamin E – especially alpha-tocopherol (the only form listed on the nutrition facts of food packaging labels).

At the time, "Neil was looking for any agronomically useful traits in his mutation breeding program, like earlier flowering,

male sterility, elongated internode and apomixis but had the most success with semi-dwarfism," Anna noted. "The giant embryo and a low phytic-acid mutant were examples of mutations that resulted in a change in grain traits."

## Kernel oddity

In the case of GEDrew, additional laboratory and field work revealed value in what initially appeared to be a genetic kernel oddity.

"This is the only study on a giant embryo rice mutant in the United States and one that's a tropical japonica-type rice adapted to the US growing conditions," noted Chen, who co-authored a paper on the finding in the November 2019 issue of *Cereal Chemistry* together with Anna McClung, Casey Grimm at the ARS Southern Regional Research Center in New Orleans, Louisiana, and Christine Bergman (formerly with ARS) at the University of Nevada in Las Vegas.

Anna said their research has a two-fold purpose:

- To broaden the market opportunities for growers; and to,
- Enhance the nutritional value of rice, a staple food for more than half the world's population.

In its whole-grain (unrefined) form, rice can provide a key source of not only protein, vitamins and minerals, but also insoluble fibre, essential fatty acids and bioactive compounds thought to contribute to dietary health.



Rice starch and protein are found in a wide range of products, including frozen foods, sauces, soups, dressings, reduced-fat baked goods, baby food, health bars and medicinal tablets. (PHOTO: Peggy Greb)

# New technology can 'sniff out' crop diseases

**T**WO ground-breaking new technologies, the Plant Sniffer and BioScout, could potentially change the speed with which Australian grain growers can identify and respond to crop disease outbreaks.

These innovative technologies and more will be discussed at the Grains Research and Development Corporation (GRDC) Grains Research Update, Perth, which will be held at Crown Perth on February 24 and 25.

## The Plant Sniffer

Professor Jean Ristaino, of North Carolina State University, will outline the ground-breaking work her team is doing in the development of a portable technology, dubbed the 'Plant Sniffer', that allows growers to identify plant diseases in the paddock.

Jean and her team have developed the handheld device, which is plugged into a smartphone, and works by sampling the airborne volatile organic compounds (VOCs) that plants release through their leaves.

By measuring the type and concentration of VOCs being released by the plant, the Plant Sniffer can quickly determine, in the field, whether a plant is diseased and which disease it has.

Current disease identification techniques rely on molecular assays, which take hours to perform in a laboratory. Getting a sample to the laboratory and waiting for testing can delay disease identification by days or weeks.

"Our technology – that we are now ready to scale up – will help growers identify diseases more quickly, so they can limit the spread of the disease and related crop damage," Jean said.

## BioScout

Discussing the BioScout platform will be Lewis Collins, one of the founders and chief executive officer of the company BioScout, that builds real-time airborne disease detection sensors for agriculture.

BioScout allows growers to track and monitor disease in their fields in real-time via disease sensors.

The patented sensors automatically collect and detect disease-causing particles in the air.

By detecting these particles, BioScout allows growers to gather information on the best intervention and protection practices for their crops based on the location and type of disease detected.



**Lewis Collins is one of the developers of the new BioScout technology.**

It uses a combination of biological air sampling, mapping and data analytics to track disease spread. The sensors are placed throughout the field, collecting disease data 24 hours a day, seven days a week.

Lewis will discuss how BioScout has been developed and tested from initial scientific validation through to commercial applications.

## Opportunity for interaction

The two-day Grains Research Update, Perth, is an important source of agronomic and industry information and resources, and a key opportunity for interaction between advisers, growers and other industry personnel.

This year, the cost of attending has been reduced to encourage even greater participation from industry and growers.

The maximum price will be \$300, for which participants will receive two packed days of information with more than 50 presenters talking about the latest research results and innovations to assist on-farm profitability.

More than 40 concurrent sessions will be held over the two days on important issues impacting on grower profitability – ranging from specific crop agronomy, nutrition management and weed control through to frost and soil constraints.

Extended focus sessions on the second day will cover: Coping with climate change, external crop protection challenges and how to implement integrated pest management systems on-farm.

The GRDC Grains Research Update, Perth will be followed by five regional one-day GRDC Grains Research Update events at the following WA locations:

- Kwinana West Zone, Corrigin Recreation and Events Centre – February 27.
- Kwinana East Zone, Merredin Regional Community and Leisure Centre – February 28.
- Geraldton Zone, Yuna Community Centre – March 6.
- Albany Zone, Jerramungup Sports Centre – March 11.
- Esperance Zone, Lake King Hall – March 12.

For more information or to register for the Perth and regional events, visit the GRDC website, or contact convenor the Grain Industry Association of WA (GIWA) on 08 6262 2128 or [researchupdates@giwa.org.au](mailto:researchupdates@giwa.org.au)



**Jean Ristaino will talk about the new Plant Sniffer.**



# World grain outlook welcomes new year with very little fanfare

■ By Peter McMeekin

**R**ELEASED in mid-January, that particular USDA World Agricultural Supply and Demand Estimates (WASDE) report tends to be quite significant, given that it's usually the final numbers in terms of yields, harvested area and production for the crop year in the US.

But the case is not yet closed on 2019 US production as the USDA acknowledged it would resurvey producers in Michigan, Minnesota, North Dakota, South Dakota and Wisconsin for corn production and Michigan, North Dakota and Wisconsin when it comes to soybean production.

Heading into the report's release, much of the market chatter suggested that the report would be bullish, based on the expectation of lower summer crop yields. But the opposite happened with the USDA raising the national yield for both corn and soybeans.

US corn production was forecast at 347.7 million tonnes (mt) with an average national yield of 10.55 tonnes per hectare, slightly higher than the previous month's yield estimate of 10.48 tonnes.

Globally, corn production in South America was left unchanged by the USDA with Brazil and Argentina forecast to produce 101 mt and 50 mt respectively. These numbers seem to belie the dry conditions being experienced in many parts of Brazil and Argentina this summer.

The only production increase amongst the major exporters was for Russia which the USDA increased by 0.5 mt to 14.5 mt. The wash-up of all the changes was a slight increase in global output to 850 mt excluding China – and 1,111 mt including China.

But the bullish part of the corn equation comes in the demand number – increased by more than 6 mt globally compared to the December report. The US accounted for just under 6 mt with a 1 mt increase in China countered by a 500,000 tonne decrease in Ukraine and several other minor downward revisions.

The USDA pegged final 2019 US soybean production at 90.4 mt, on an average yield of 3.19 tonnes per hectare compared to 90.2 mt and an average yield of 3.15 tonnes per hectare in the December report. This was a surprise to most analysts who expected to see the impact of the extremely challenging season continue to ripple through the country's soybean supplies. Nonetheless, this is still 20 per cent lower than the previous season's production of 112.5 mt.

Like corn, the South American soybean production numbers remain steady with Brazil estimated to produce 123 mt this summer and Argentina expected to harvest 53 mt. Brazil's National Supply Company (Conab) released estimates in mid January that seem to ignore drought worries and support the USDA number. They are forecasting soybean production at 122.2 mt off 36.8 million hectares.



Peter McMeekin.

Eventually, soybean losses will happen if it remains dry, but most agronomists believe that the current lack of moisture only affects the first corn crop at this point in the season. The Brazilian state raising the biggest concern is Rio Grande do Sul – the top summer corn producer in the country. Conab maintained its estimate for first crop corn production at 26.6 mt, down 3.8 per cent compared with 2019, based on a 1.1 per cent increase in the seeded area.

## Global wheat production outlook

When it comes to wheat, global production for the 2019–20 marketing year was reduced by a meagre 1 mt to 764.4 mt. Half of that decrease was in Australia, where the USDA decreased production by 500,000 tonnes to 15.6 mt. While this is getting closer to reality, it is still at least 1 mt higher than the majority of domestic estimates.

Argentine wheat production remained at 19 mt against the latest Buenos Aires Grain Exchange (BAGE) estimate of 18.8 mt. BAGE increased their estimate by 300,000 tonnes on the back of better than expected yields in the late-harvested regions. The balance of the global production decrease was in Europe with the Russian crop decreased by 1 mt to 73.5 mt and the European Union (EU) crop increased by 500,000 tonnes to 154 mt.

On the wheat export front, global trade for the 2019–20 marketing year was increased by 1.3 mt to 181.1 mt. The US, Argentine and Canadian numbers were all unchanged compared to the December report. The major tweaking was in Europe where the Ukrainian and EU export numbers were increased by



US corn production for 2019 was forecast at 347.7 mt.

500,000 tonnes and 2 mt respectively, and the Russian forecast was decreased by 1 mt on the back of lower supplies.

The USDA adjustment to the Australian wheat export number was hardly worth the token effort with a mere 200,000 tonnes shaved off expectations. Like the production forecast, the figure of 8.2 mt is at least 1 mt higher than most domestic expectations, and it simply should not be possible given domestic demand and the poor harvest receipts in Western Australia and South Australia.

Looking at the US new (harvest in 2020) crop, the USDA reckons their farmers have planted 12.47 million hectares of winter wheat. This compares to 12.61 million hectares last year and is the smallest winter wheat area since 1909.

On the barley side of the equation, global production was decreased by 700,000 tonnes to 156 mt – up more than 12 per cent, or 17.4 mt compared to the 2018–19 season. Australia was down 200,000 tonnes to 8.2 mt, EU up 500,000 tonnes to 62.75 mt and several minor producers collectively down by 1 mt.

The net change to global demand was minor at 100,000 tonnes, but the USDA did make some quite hefty regional adjustments to arrive at total demand of almost 153 mt. The big one was a 900,000 tonne decrease in Chinese demand – potentially decreasing Australian exports over the coming months.

Countering that were demand increases of 400,000 tonnes in the European Union and 600,000 tonnes in Turkey. Most importantly, Saudi Arabian demand was untouched at 8.5 mt – a year-on-year increase of 20 per cent or 1.5 mt.

All this leaves 2019–20 global ending stocks at just under 21 mt, down 1 mt on last season's number.

It could be said that the January WASDE report was mildly bullish for wheat, barley and corn, but on the whole, it was quite underwhelming for a report that invariably has huge trade and market ramifications.

**Call your local Grain Brokers Australia representative on 1300 946 544 to discuss your grain marketing needs.**

## INDIAN OCEAN DIPOLE RETURNS TO NEUTRAL TERRITORY...

Extreme weather conditions and unprecedented bushfires across many parts of the Australian continent have been dominating the news cycle over the past few weeks. The extent of the catastrophe and the tragic loss of human life has touched all Australians, and many across the globe.

While all this has been happening the weather phenomena that underpinned Australia's warmest and driest year since records began has finally broken down, returning to a neutral state in late December after sitting in positive territory since July last year.

The Indian Ocean Dipole (IOD) is one of the key drivers of Australia's climate. The IOD measures the difference between seas surface temperatures in the tropical parts of the western and eastern Indian Ocean.

It has three phases; positive, neutral and negative. The different phases impact rainfall and temperature patterns over the Australian continent by influencing the trajectory of weather systems to the south of the country.

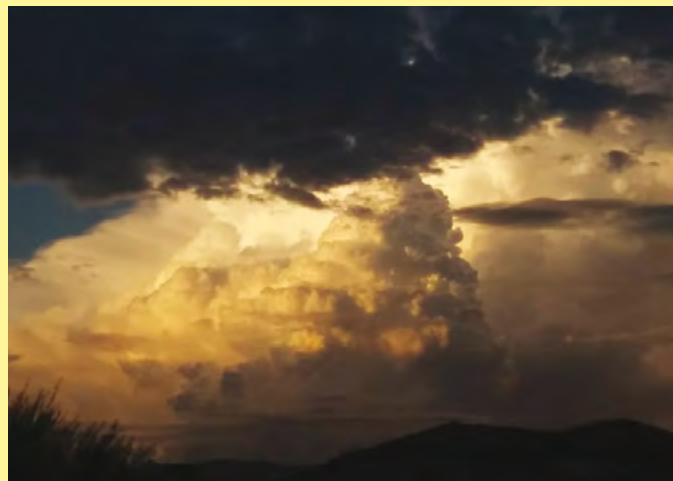
Under a negative IOD phase the sea surface temperatures in the eastern Indian Ocean (off the northwest coast of Australia) are warmer than average, while in the western Indian Ocean the sea surface temperatures are cooler than average.

### **A negative IOD – a big positive for Australian farmers!**

This usually results in above-average winter and spring rainfall over many parts of southern Australia as the warmer waters off the northwest coast deliver more available moisture to weather systems crossing the country. This is the most favourable phase for agricultural production in Australia, particularly in the southern two thirds of the continent.

A positive phase means that the sea surface temperatures in the eastern Indian Ocean are cooler than average with the opposite occurring in the western Indian Ocean. The result is an increase in the intensity of easterly winds across the equatorial Indian Ocean region pushing the warmer waters towards Africa.

This generally means there is less moisture than normal in the atmosphere to the northwest of Australia, frequently resulting in less rainfall and higher than normal temperatures over Australia during winter and spring. The impact of a strongly positive IOD on agricultural production can be dramatic, as we have seen over



**The IOD phases and monsoons are linked.**  
(PHOTO: Jason Caywood)

the past six months. A positive IOD is also often associated with a more severe bushfire season in the southeast of the continent.

IOD events, whether positive or negative, generally end in late spring or early December, meaning the decline of the positive event in 2019 was much later than normal. This is tied to the delayed migration of the monsoon trough into the southern hemisphere and the accompanying changes to wind patterns over the tropical reaches of the Indian Ocean.

It is the monsoon's interaction with the IOD that normally brings about the end of an IOD phase.

Meanwhile, most models of the El Niño–Southern Oscillation (ENSO) – the primary climate driver in the Pacific Ocean – have it continuing in a neutral band until at least April of this year.

A neutral ENSO generally means that its influence on Australian and global weather patterns is much reduced compared to El Niño or La Niña phases.

With both the IOD and ENSO now in neutral territory we start 2020 with fewer impediments to more normal weather patterns. While this doesn't portend the weather in Australia will change immediately, if the models are correct, it does take these two prevailing climate drivers out of calculations ahead of the next winter crop planting window.



# You need to understand these three factors when pricing grain

■ By Andrew Whitelaw, Mecardo

## AT A GLANCE...

- Over a long horizon, the majority of the Australian grain price is determined by overseas factors.
- In times of low supply, basis will become more important.
- Our wheat becomes more attractive on a global level when the Australian dollar falls.

It is always important to be thinking towards the future when planning your grain sales. Following is a refresher to the components of pricing that you need to know in order to have an effective marketing strategy.

The wheat price in Australia is comprised of three components:

- Futures;
- Currency/foreign exchange; and,
- Basis.

### Futures

The first component of an Australian grain price is the futures price. A futures contract is an agreement to buy (or sell) an asset such as a commodity at a predetermined date and price. In general, in Australia when people talk about basis they are referring to the difference between our price and the Chicago wheat futures. The market generally uses this contract as it the world's largest wheat market giving access to a high level of liquidity.

But it's important to note that there are other contracts which can be used. See previous Mecardo articles such as *J'habite en Australie, Is America still relevant?* And *The Australian black sea*

### Currency

The lion's share of Australian wheat is exported, and with our price being based on the Chicago contract in USD the local price

is heavily influenced by movements in the A\$/US\$ rate. In Figure 1 we can see the influence of differing rates would have had on local grain prices. The grey line shows the actual price converted at the prevailing exchange rate, the orange line represents a 10¢ lower A\$ and green line 10¢ higher.

In early January spot Chicago futures converted to A\$295 per tonne – a 10¢ rise would reduce prices to A\$258 and a 10¢ fall would increase pricing to A\$346.

### Basis

The 'basis' component of a price can be simplified down to the difference, between the local price and the price of a futures contract. This basis can either be negative or positive, but in recent years we have been lucky to have strong (positive) basis levels for the majority of the time (Figure 2).

The basis level is impacted by a number of factors such as grower selling, domestic supply and freight costs. If for example there was limited grower selling and traders required grain in order to fill shipping requirements, we would expect basis to strengthen.

### We are removed from the rest of the world... or are we?

The basis level is largely driven by domestic factors. When we have a large crop the basis level drops, conversely a small crop leads to higher basis levels. It is important to be monitoring basis levels as they provide a indicator of when it is best to sell.

During this drought we have seen basis level rise to extraordinary levels, with the highest levels clearly being in the areas where the supply was diminished, and demand remained strong (Figure 2). At points during the drought basis levels in Port Kembla achieved +A\$215 over spot futures.

This has made many believe – both producers and consumers

FIGURE 1: CBOT wheat converted to AUD/tonne



FIGURE 2: APW1-CBOT Basis





At points during the drought, basis levels delivered Port Kembla were more than A\$215 above spot futures.

– that there is no need to consider the overseas price. This is not the case, in order to protect from adverse price risk, the futures market needs to continue to be a considered.

In Figure 3 basis is displayed as a percentage of the overall price. At the height of the drought pricing basis levels approached on average 40 per cent on the east coast, but have since declined. In recent times for instance Geelong, Adelaide and Kwinana have reverted close to their long term averages.

At present, the overwhelming majority of price is comprised

of the futures pricing component, which can be easily hedged on long horizons.

For more information go to [www.mecardo.com.au](http://www.mecardo.com.au) and listen to the Commodity Conversation podcast by Mecardo.

FIGURE 3: Basis as a % of overall wheat price



## AT A GLANCE...

- Basis reached record levels in 2018;
- Basis is an important component in grain pricing but is usually not the main driver;
- Basis historically comprises less than 20 per cent of the overall cost of grain in Australia.
- Basis is an important factor when pricing grain. As a producer when basis is high it is better to sell basis and maintain exposure to futures; and,
- As a country that typically exports wheat, overseas futures are the biggest driver of prices in Australia. Although drought can cause large swings in pricing at a local level, it is important to still consider overseas futures in your marketing strategy.

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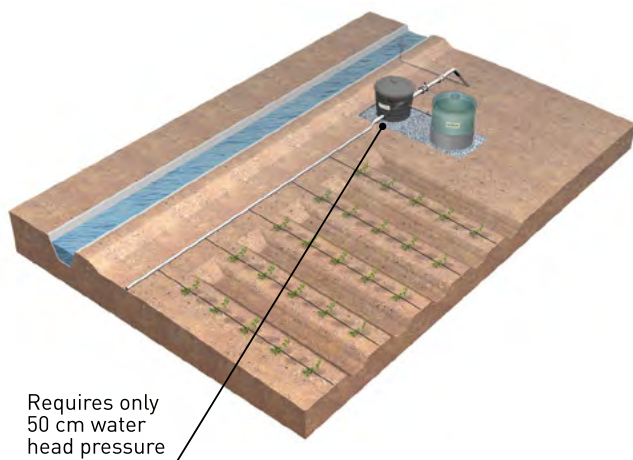




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# Now – and then!

■ By Ian M. Johnston

**For nigh on 30 years, readers of this and other magazines produced by Greenmount Press, have been required to tolerate my epistles relating to the history of farm tractors, plus the pioneering days of agriculture in Australia and perhaps too frequently, my somewhat egocentric personal memoirs.**

This very morning (Editor's note: This article was written on November 19, 2019) I sat down at my desk with the intention of tapping out yet another dissertation, which hopefully would attract the attention of at least a handful of readers. I was very conscious of the fact that I was cutting things a bit fine, which worried me because I have never yet failed to meet the editor's uncompromising deadline, the consequences of which would no doubt result in the failure to receive a bottle of his fine vintage wine at Christmas time.

But perhaps my tardiness may be excused when I point out that for the past 10 days I have been in a state of severe apprehension, owing to the horrific bush fires all around the Mid Coast of NSW and in particular our region of Rainbow Flat, situated south of Taree. At 10 pm a week or so ago, Margery and I were urged (indeed ordered) by the volunteer fire fighting guys, to immediately evacuate our modest property, as it was being surrounded by a raging windstorm driving an inferno of immense proportions.

## **The instruction was brief – “Get the hell out of there!”**

Fortunately, as a result of our evacuation plan, a packed suitcase plus important documents were already in one of our vehicles, parked strategically at the top of our drive. So we abandoned ship – at the rate of knots!

All roads and highways were closed, apart from a portion of

The Lakes Way, which enabled us to reach the sanctity of Forster/Tuncurry.

Being a popular seaside resort, there are numerous motels in the twin towns, but following an exhaustive run-around in the dark of the evening, to our dismay – there were simply no vacancies. Folks from our threatened area, who were also forced to flee their properties, had arrived ahead of us.

But a charming elderly couple, with whom we had no prior acquaintance, discovered our plight and with a magnanimous display of kindness and generosity, insisted we spend the night in the comfort of their charming home.

The following morning, not wishing to impose further upon their hospitality, we obtained a vacancy in a motel, in which we were ensconced for a further several days. The road to our property was closed due to continuing fierce fires and dense smoke, plus the resultant fallen trees across the road.

Entirely due to the efforts and professionalism of scores of absolutely magnificent volunteer firemen, our property remained untouched by the ferocious fires. Accordingly, our home, sheds and my archives crammed with irreplaceable historic tractor material, all survived intact. How can I ever thank these remarkable firemen?

Alas, there were many surrounding holdings that were either partially or totally ravaged!

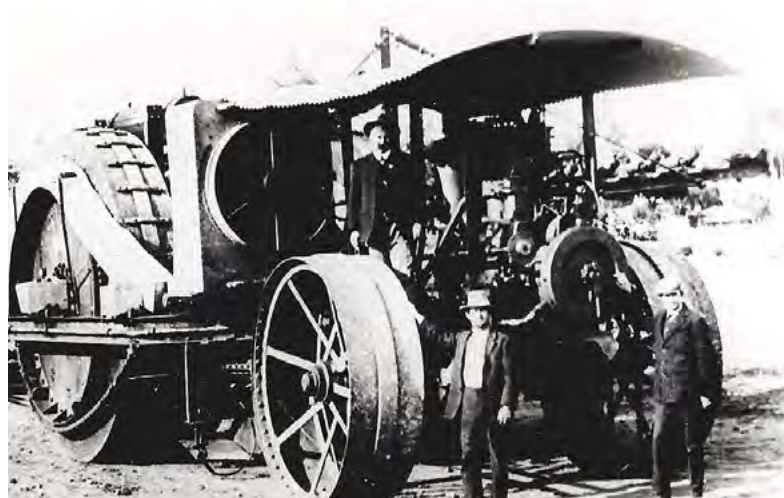
I realise of course that our alarming experience was being replicated by thousands of country folk throughout many areas of Victoria, NSW and Queensland.

I am also mortified by the consequences of the current appalling drought inflicting vast regions of Australia. A lady, who was our neighbour in the days we owned a western grazing and farming property out in the Walgett Shire, rang to inform me that no rain had fallen on their family acres for three years and the place has degenerated into resembling a giant dust bowl. Awful!

I note the media is currently reporting a considerable amount of altercation between political parties, each blaming the other for failing to prevent the bush fires. As I am certainly not a



**Neil McDonald, son of A. H. McDonald, who founded the firm in 1903. Neil is at the controls of a 1936 McDonald TWB, powered by a single cylinder 2 stroke semi diesel 40 h.p. engine. (PHOTO: IMJ)**



**The 1911 McDonald Castles. (Courtesy Neil McDonald)**





**A 1916 McDonald EAA harvesting in Victoria.**  
(Courtesy Neil McDonald)

political reporter (indeed am tasked solely to write about classic tractor matters) I shall control my emotions and refrain from expounding a political opinion – except to state the following.

Decades ago, in my jackerooing days and later when I roamed the bush on a series of 1950s motor cycles picking up casual tractor driving work here and there, cattlemen were encouraged to graze their herds within the confines of National Parks and other forestation areas. As a result, the floors of the forests were maintained relatively clear of the combustible undergrowth hazards we see today and which so often become the epicentre of the fires.

Vote seeking politicians were influenced by ‘alleged’ conservationists and proclaimed the closure of forests to cattle grazing! I shake my head!

But now back to business.

## The unique 1911 McDonald Castles

While we are accustomed to seeing some seriously big tractors out in the broadacre paddocks these days, consider the specifications of this 1911 machine.

- Length: 9.45 metres (31 feet).
- Width: 4.88 metres (16 feet).
- Height: 4.88 metres (16 feet).
- Rear wheel diameter: 3.35 metres (11 feet).
- Front wheel diameter: 1.98 metres (6.5 feet).
- Weight: 20 tonnes (20 tons).

The design of this massive tractor incorporated a patented excavating plough, attached adjacent to each of the giant driving wheels. As the tractor slowly progressed along its course, the ploughs excavated irrigation channels. Simultaneously, as the wheels rotated, the excavated material was transported in buckets, which had been attached to the inside of the wheel rims, and raised aloft, then tipped onto an endless belt conveyor and finally dumped alongside to form the banks of the channel.

This simplistic concept was the brainchild of a brilliant inventor named Wesley Castles. Hitherto, irrigation channels had to be



**A 1936 McDonald – possibly the very first to be fitted with pneumatic tyres.** (Courtesy Neil McDonald)

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**A 1935 McDonald TWB operating on a sugar plantation in Northern Queensland. (Courtesy Neil McDonald)**

laboriously dug by manual labour utilising picks and shovels, with horse drawn carts used to convey the soil to form the banks.

The few tractors that existed in 1911 were mainly powered by two or four cylinder engines producing between 20 and 30 horse power. Accordingly, as it obviously required a more powerful and robust engine to operate the big machine, A. H. MacDonald designed and built a four cylinder water cooled petrol unit

capable of producing 120 hp. To do so proved quite a challenge. But in the end the engine performed adequately and posed no problems, apart from a horrendous fuel consumption.

When the construction of this gargantuan tractor was completed, the rear brick wall of the A. H. McDonald and Company factory at Richmond, Victoria, had to be demolished in order to permit the machine to venture out into the big wide world.

The McDonald Castles was then required to be driven to the State Government Werribee Research Farm for mandatory testing. As the majority of Melbourne's bridges in 1911 were designed for horse traffic, it was essential to survey a special route for the 20 tonne machine, which also included not having to travel under bridges – remembering that its height was 4.88 metres (16 feet). Despite having a travelling speed of a mere 5 km per hour (3 mph), without the aid of power steering, navigating along the winding roads was a nightmare and required an enormous degree of physical strength on behalf of the operator.

But all went well until the suburb of Clifton Hill was encountered. Upon having to descend a steep hill, the operator confidently eased back on the throttle control. Nothing happened! A rod had become disconnected! The 20 tonne tractor picked up speed – not gradually but rapidly. In a matter of moments it went hurtling downhill at near breakneck speed.

Fortunately a steep bank slowed its progress, plus a paling fence and a brick wall, without which it would have demolished a cottage, which lay directly in its path. There is no record of the operator's heart beat as the machine jolted to a halt, centimetres from the aforementioned cottage.

Little more is known of the McDonald Castles, despite my research. But apparently, following extensive work in the irrigation regions of Victoria, the unit was put to work digging ditches for the overland railway, somewhere west of Port Augusta in South Australia.

Perhaps this unique tractor now lies abandoned deep in the Nullarbor, where decades of sighing winds would have gently entombed it in the desert sands. ■

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## IAN'S MYSTERY TRACTOR QUIZ

**Question:** Can you identify this very attractive crawler tractor?

**Clue:** It is British and powered by a side valve Ford V8.

**Degree of difficulty:** Hard – unless you have read Ian M.

Johnston's books!

**Answer:** See page 48.





# Nutrient removal data helps growers plan the next crop

**N**EW data is being collected to help grain growers fine-tune their fertiliser recommendations based on the nutrients removed at harvest. Heath Boseley, from Pinnaroo Fertiliser, started a district-wide grain testing program at the end of 2018, encouraging all of his farmer customers in the Murray–Mallee region of South Australia and Victoria, to provide a grain sample for nutrient testing.

Grain nutrient testing quantifies the actual nutrient removal from the paddock, so growers aren't relying on national averages or rules of thumb.

"It's hard to see how published averages can be meaningful for growers," said Heath. "The data is pretty old, it's not specific to your local area – in our case, the Mallee – and it's not based on the type of seasons we're now experiencing. I thought it was time to ground truth these figures with some testing."

Heath sent all his customers sample bags to be returned to him with a small sample of grain.

Growers who provided a grain sample were given their individual grain test results and he also collated the results to provide customers with district-wide averages for a range of nutrients in different crops.

He said most Mallee growers worked on the assumption that a wheat crop removed 3 kg of phosphorus and 40 kg of nitrogen per tonne of grain. But based on the 50 grain test results he received back from the Nutrient Advantage laboratory after the 2018 season, Heath was able to tell his customers that average phosphorus removal was actually 2.7 kg of phosphorus per tonne of grain for that year.

"So far we only have one year's data to go on, but over the next few years we'll start to build a more complete picture of nutrient removal from crops in the Mallee," he said.

## Nutrient removal information is already useful

While Heath plans to continue to collect nutrient removal data for the next three to five years, the early information has already proven valuable. Grain nutrient removal figures were already being used in nutrient budgeting, along with yield results, paddock histories and soil test results to ensure enough fertiliser was applied for the coming crops and to avoid nutrient run down.

"When we got this information back at the start of last year, growers were making tough decisions about their fertiliser programs," he said. "The growing season rainfall had only been around 150 mm and there had been spring frosts as well."

"This season hasn't been much better, with rainfall below average again and a series of hard frosts, but it's amazing what's been harvested."

One grower who is grateful for the new information being collated is Giles Oster, farming wheat, barley, lentils, canola, oaten hay and vetch near Pinnaroo.

Fertiliser decisions are made using a replacement fertiliser strategy based on paddock histories for the past couple of years and backed up by results from annual soil testing.

"To be able to measure what is removed in the grain is worth a lot to us," Giles said. "You can guess, or go on gut feel, but to have the numbers there, that really helps with making decisions."

Giles slightly reduced his phosphorus application rates in 2019, based on the data collected and the poorer yields achieved in 2018, but increased nitrogen rates.



Heath Boseley from Pinnaroo Fertiliser is running a grain testing program with his clients, including Giles Oster (centre) and David Lawson (right).

"Soil testing in autumn showed a lot of our paddocks were very low in available nitrogen, even where legumes had been grown," he said. "We've got to justify every dollar we spend on fertiliser, so the work Heath is doing and the science behind it is tremendously valuable. It's helping us get more specific with our fertiliser and be more confident in our decisions."

Although the crops came out of the ground quite well, he said the second half of the season let them down.

"This latest harvest, we've seen some good results, some bad and some downright ugly, but overall we're very fortunate with what we've got despite frost and lack of rainfall," he said.

Nearby, David Lawson is farming 1600 hectares just north of Pinnaroo and he set aside grain from the 2019 harvest for nutrient testing.

"The more information we can get, the better and grain nutrient testing isn't really that hard to do," he said.

Last season's crop was marred by a series of frosts, with temperatures as low as  $-7^{\circ}\text{C}$ . This wiped out 200 hectares of wheat and reduced the rest of the wheat yields by half, while barley yields were less affected.

With yields ranging from less than a tonne through to 3.5 tonnes per hectare, David is considering pre-spreading some fertiliser on selected paddocks to replace the nutrients removed before using a blanket starter fertiliser rate at sowing.

"We use soil testing, grain testing and all the information available to us to make sure we're giving crops the fertiliser they need," he said. "I think the main risk is with under-fertilising because you've got to capitalise on the good years."

"The only way we made the yields we did last year was to take the chance to fertilise when there were good rain events, and on paddocks that we knew were going to respond."

# Using cereal crops to address iron and zinc deficiency across the globe

■ By the Agricultural Research Service – USDA

**T**HE following article is based on an interview conducted by the ARS's Under the Microscope (UM) team with Dr Elad Tako, a research physiologist at the Robert W Holley Center for Agriculture and Health in Ithaca, New York state. Elad recently presented at the USDA's Beltsville Human Nutrition Research Center on the subject: "Improving Food Security with Iron-Enriched Cereal Crops."

**UM** – Let's start by talking about the health benefits of zinc and iron, two minerals that we often do not consume enough of. Why do our bodies need zinc and iron and what are the health risks associated with deficiency?

**Elad:** Iron and zinc hold key roles in numerous metabolic processes in the body. Zinc and iron dietary inadequacies have been associated with stunted growth, impaired physical and cognitive development, anemia, depressed immune function, increased vulnerability to and severity of infection, adverse outcomes of pregnancy, and neurobehavioral abnormalities. Deficiencies of iron and zinc are major causes of early childhood morbidity and mortality, primarily in developing countries.

**UM** – Over two billion humans are iron and zinc deficient, a staggering number. Why are so many people deficient globally, and how is your research benefitting communities most at risk?

**Elad:** Iron deficiency affects around 40 per cent of the world's population, particularly women and children in developing countries. Iron deficiency is highly prevalent in low-income countries due to a lack of meat consumption and a notable dietary reliance on grains containing high amounts of iron absorption inhibitors. In the US, approximately 10 million people are iron deficient (i.e. 3 per cent of the population).

Our research is focused on developing and using tools to investigate and understand how we digest and absorb certain foods, and their interaction with microbes in our body, so we can better strategise potential nutritional approaches aimed at alleviating dietary deficiencies in specific populations.

**UM** – Your research uses a novel approach to identifying food crops rich in zinc and iron, please explain?

**Elad:** In order to identify iron dietary bioavailability, we are using a combined approach of *in vitro* and *in vivo* models to assist in the developing process of staple food crop varieties and predict their effect on iron and zinc status in humans. For example, we observed that the broiler chicken model (Figure 1) exhibited similar responses to iron and zinc deficiencies as a human and thus may be useful as a model for iron and zinc bioavailability and absorption in humans. Further, we use novel physiological, molecular, morphological, and microbial biomarkers to assess dietary effects on iron and zinc nutrition.

Specifically with zinc, researchers have had difficulty creating biological markers to determine mild to severe levels of deficiency. I developed a novel biomarker of zinc status that can be used as an additional indicator for assessing zinc status more precisely in humans. This is a key development in the field of zinc nutrition, and will allow for a more accurate assessment of a subject's zinc physiological status due to dietary intervention and in the context of zinc-enhanced staple food crops.

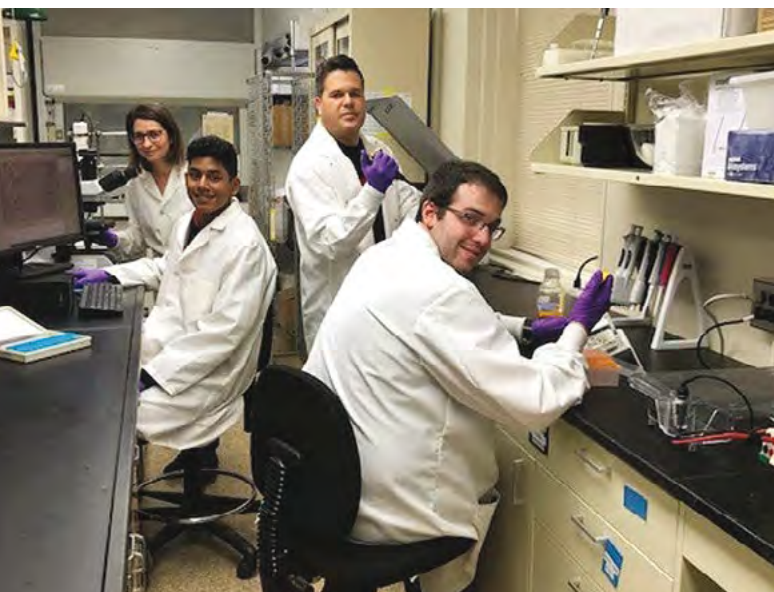
**UM** – How is your research changing the world's diet to ensure humans are consuming more nutrients like iron and zinc?

**Elad:** By highlighting the importance of dietary zinc and iron for various metabolic pathways, we can further demonstrate their key role when included in a balanced diet. For example, we were able to demonstrate that iron deficiency is affecting the intestinal microbial populations, which may lead to increased vulnerability for measles, influenza A, hepatitis C, and staphylococcus infection. Similarly, zinc deficiency also affects the intestinal microbial profile, and this effect may lead to reduced digestive and absorptive functions of the small intestine.

This is a collaborative effort with ARS scientists and domestic and international research institutions to try to alleviate iron and zinc deficiencies in vulnerable populations. Our overall goal is to increase the knowledge related to iron and zinc nutrition and better understand how factors such as prebiotics, bioactive compounds (as polyphenols), and the intestinal microbiome may affect dietary iron and zinc availability and absorption.

**UM** – Eating more foods rich in iron and zinc is important, but absorption also plays a key factor, correct?

**Elad:** Correct. Certain foods high in phytic acid and polyphenols chelate iron and zinc (i.e. dark coloured beans) limit these minerals' dietary availability and absorption, while foods high in ascorbic acid (citrus fruit, cantaloupe, strawberries, raspberries, blueberries, and cranberries), and fermentable fibre (legumes) increase iron and zinc availability and absorption. This is especially relevant in populations that rely on staple food crops as their main sources of dietary iron and zinc because these populations may not be getting enough foods with high zinc and iron absorption properties.



ARS scientist, Elad Tako (back right), and laboratory technician, Nikolai Kolba (front right), prepare samples to be run on a qPCR system aimed to assess intestinal proteins expression. Student Dasun Priyawardhana (front left), and visiting professor (Hercia Martino) are measuring intestinal villi size and goblet cells diameter.



## We need to eat more plant-based fibre

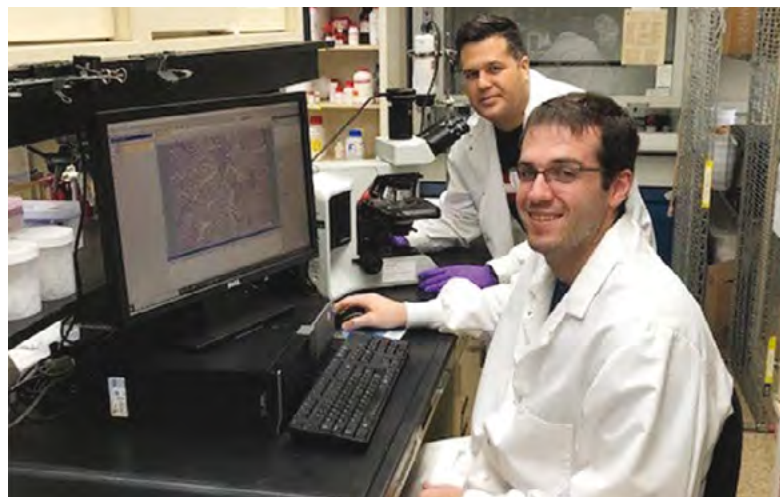
**UM** – We are all learning about the vital role of the gut microbiome to our health. What has your research found with regards to the microbiome, and what should we eat more of to ensure a healthy gut?

**Elad:** The human intestine harbours a complex and dynamic gut microbiota, heavily influenced by host genetics, environment, and diet. The gut, which houses the majority of these microbes, is an important organ in the absorption of micronutrients (such as zinc and iron) from the diet. We have demonstrated that severe zinc deficiency negatively affects the composition of the intestinal microbial populations, and an iron deficient microbial profile may lead to increased chances to develop influenza A, measles, and hepatitis C.

In order to ensure a healthy gut and a healthy microbiome, it is vital to include food sources that are rich in fibre (such as whole grains, fruits, and vegetables). Dietary fibre survives the initial digestion in the stomach and upper intestine, and ‘feeds’ health promoting bacterial populations that mostly reside in the lower intestine and colon.

**UM** – How do prebiotics and probiotics work in concert to maintain a healthy gut, and where can people find these in their everyday foods?

**Elad:** Prebiotics are non-digestible food ingredients that selectively promote the proliferation and/or activity of health-promoting bacterial populations (probiotics) in the intestinal colon and, thereby, exert a health-promoting effect and decrease the risk of chronic diseases.



**In order to assess the dietary effects on the intestinal brush border membrane morphology, ARS physiologist, Elad Tako (back) and Biological Laboratory Technician (Nikolai Kolba) use a microscopic system.**

In studying pre and probiotics, my research team has demonstrated that fibre extracted from chia seed, beans, wheat, wheat bran, lentil, and chickpea positively affected the small intestinal digestive and absorptive surface functionality and development, and increased the abundance of health promoting bacterial populations (probiotics).

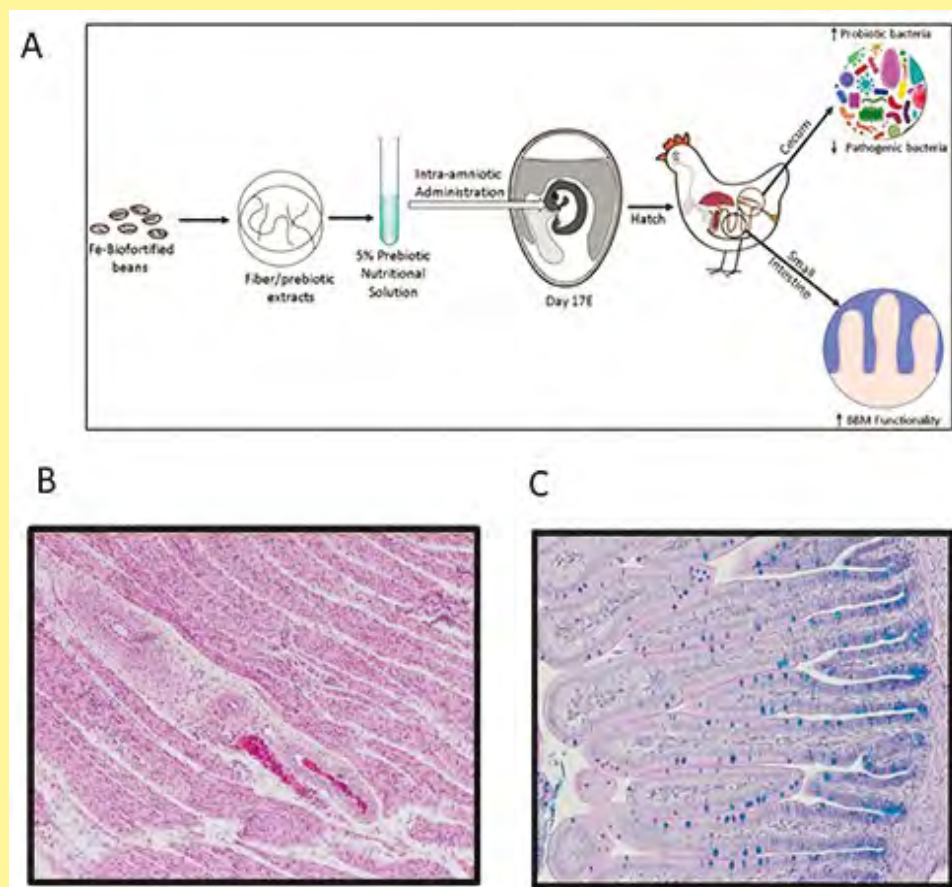
**UM** – How can people with celiac disease, wheat allergies, or wheat-free diets still consume enough foods rich in zinc and iron?

**Elad:** Indeed food/grain allergies and conditions like celiac disease may limit the consumption of grains, primarily wheat. But other sources such as legumes can certainly provide plant-origin food alternatives/additions that are rich in micronutrients (mineral and vitamins), fibre, and protein. These include, chickpea, beans, lentils, and peas. Beans, chickpea, and lentil flours are now being used as wheat flour alternatives in baked goods, breads, and even pasta products.

**UM** – I’m sure people who learn what you do for a living probably ask, “what should I be eating more of?” What do you tell them?

**Elad:** Increase your consumption of dietary fibres and non-digestible starch. This includes whole grains (such as whole wheat and rice products), nuts (such as walnuts and almonds), and legumes (such as chickpeas, lentils, beans, and peas). In addition to positively influencing the intestinal microbiome and nutrients’ digestive and absorptive surfaces, dietary fibre may lower the incidence of cardiovascular disease and be beneficial in controlling body weight, as dietary fibre leads to a sense of fullness that may assist in avoiding excess food intake.

**FIGURE 1: The broiler chicken model**



In his research, Elad is using the broiler chicken model to assess the effects of plant origin bioactive compounds (as fibre) on intestinal functionality, and microbial populations (A). Tissue samples are collected for histological and morphometric measurement and in order to assess dietary effects on muscle growth (B), and small intestinal development.

# Biodegradable spray helps battle crop pathogens

■ By Sandra Avant, Agricultural Research Service – USDA

**A** NEW sprayable bioplastic – made of cornstarch and other natural ingredients – offers potential as an effective method for delivering beneficial microbes to fight aflatoxins and other agricultural pathogens and pests.

Aflatoxins are highly toxic substances produced by many species of *Aspergillus* fungi. Aflatoxins can contaminate corn, peanuts, cotton, and other crops, and at high doses they threaten the health of people, pets, fish, livestock, and other animals. They have been known to cause acute and chronic liver injury and liver cancer.

But not all *Aspergillus* fungi produce aflatoxins; some strains are considered beneficial. USDA Agricultural Research Service (ARS) scientists are using helpful *Aspergillus* species to prevent harmful ones from contaminating crops like corn.

Aflatoxin is a chronic problem in the southern United States, says plant pathologist Hamed Abbas, with ARS's Biological

Control of Pests Research Unit in Stoneville, Mississippi. Estimates of economic losses due to aflatoxin contamination vary. In the US alone, annual loss estimates range up to more than US\$200 million for corn and US\$500 million for corn, peanuts, and other crops combined.

Most countries prohibit the sale of corn or any other grain that contains more than 20 parts per billion of aflatoxin. Grain that exceeds this level cannot be used for human or animal consumption.

## Melted bioplastic mixed with biocontrol agents

In earlier research, published in *Crop Protection* in 2011, Hamed, other ARS scientists, and collaborator Cesare Accinelli with the University of Bologna, Italy, encapsulated a nontoxic, beneficial strain of *Aspergillus* in granules of bioplastic – a biodegradable plastic derived from organic substances rather than petroleum.

The granules worked well in reducing aflatoxins when spread onto soil in the furrows between waist-high corn plants. But growers needed a more efficient and effective method of delivering the beneficial *Aspergillus*.

Recently, Hamed and Cesare developed a sprayable biodegradable formulation that makes it easier to apply beneficial agents to soil, plants, and seeds.

In studies, published in *Pest Management Science* in 2016 and the *Journal of Agricultural and Food Chemistry* in 2017, aflatoxin contamination of corn was reduced by 97 per cent using this system.

"With the sprayable method, we don't have to put the beneficial fungus or spore on a granule of bioplastic," Hamed says. "We melt the bioplastic into a liquid, mix in the biological control agent – a nontoxic, beneficial *Aspergillus* in this case – and then spray it on the plants or coat the seeds with it."

Other formulations and approaches are helpful in controlling aflatoxins, but there is no silver bullet for commercial use, Hamed says. Biological control is the most effective so far.

"The beauty of the bioplastic is that it's made of cornstarch, which is sticky," he adds. "There's no need to add other materials to make it stick to the plant or seed. Secondly, it provides nutrition for the beneficial microbes, because cornstarch is rich in carbon and energy. Thirdly, bioplastic can deliver the biological control agent to protect the plant from bad pathogens."

Another advantage of the bioplastic is that it can be delivered in one application in any form – granule, liquid, spray, or seed coating, Hamed adds. It is inexpensive, has a long shelf life, and is easy to apply.

This technology has other potential commercial applications, Hamed notes. In experiments, other microbial biocontrol agents have significantly reduced damage caused by the European corn borer in corn and the tarnished plant bug in cotton.

In addition, this technology has the potential to protect seeds from soilborne pathogens, thereby reducing damping-off disease in tomato plants.

ARS has received a patent on its bioplastic technology, which has been licensed by a commercial company.



In Stoneville, Mississippi, plant pathologist Hamed Abbas (red shirt) and his field crew prepare to spray corn with a new aflatoxin-control formulation. (PHOTO: Stephen Ausmus)



# 2,4-D resistance does not affect the fitness of radish

*Merv Hughes was not a fit-looking cricketer. Merv was a notorious consumer of food and alcohol, and it showed! Despite this, he was a successful professional sportsman. Mitchell Johnson, on the other hand, was the epitome of a fit, healthy fast bowler. But who had the better bowling average? You guessed it, big swervin' Mervin!! 28.38 compared to Johnson's 28.40. Ok, we're splitting hairs here, but you get the picture, how fit you look is only part of the story.*

If you grew 2,4-D resistant radish in pots on its own, and compared that to the good old susceptible radish of yesteryear, you would find that the resistant ones are a bit smaller overall, slightly shorter, have smaller leaves and they are slightly more dormant so they germinate a bit later.

You would think that all of this would add up to a 'less fit' wild radish plant that is less competitive with our crops.

That's exactly what AHRI researcher, Dr Danica Goggin, thought when she observed these differences in her research to work out how 2,4-D resistance works. So she studied it.

Danica grew wild radish either in pots on their own or in pots with five wheat plants to compete with.

Wheat won! By the length of the straight.

The resistant and susceptible wild radish plants were equally smashed by the competition from wheat. Five wheat plants in a pot is roughly equivalent to 100 plants per square metre and this more than halved wild radish growth and seed set. Wheat yield was completely unaffected by the presence of wild radish.

Crop competition is clearly an excellent way of suppressing wild radish, but unfortunately, it's no more effective on resistant radish than it is on susceptible radish.

Danica Goggin knows more about 2,4-D resistance in wild radish (*Raphanus raphanistrum*) than just about anyone else on the planet. It's minor fame (I) but incredibly important research as this group of herbicides play a key role in global weed control.

### Difference in growth between R & S radish

In this research, Danica measured every aspect of wild radish that you could think of and she did find some key differences between the susceptible (S) radish and the resistant radish (R). She studied two S populations and 11 R populations. The R populations were all resistant to 2,4-D and the SU herbicide chloresulfuron (Glean). There was also variable resistance to Dicamba, Imi (Intervix) and diflufenican (Brodal).

Key differences for 2,4-D resistant wild radish:

- Smaller than S plants in terms of weight, height, and size of first leaf.
- More dormant than S plants. The resistant radish germinated slightly later.

Imi (Intervix) resistant radish was shorter than Imi susceptible radish. It's hard to tell if this was just a coincidence amongst these populations or if Imi resistance does affect height.

Naturally you'd think that this R radish would exhibit less competition with wheat than the S radish, but alas, it didn't.



Australian Herbicide Resistance Initiative researcher, Danica Goggin.



Wild radish in flower. Pretty but nasty.





**Crop competition makes wild radish grow taller in the crop which means better harvest weed seed control.**

### Radish competition with wheat

Wild radish was grown either as a single plant in a pot on its own, or in competition with five wheat plants in a single pot. It's important to note that the pots were watered regularly and were well fertilised, so water and nutrients were not limiting.

**TABLE 1: Effect of wheat competition on wild radish growth and reproduction**

	One wild radish grown in a pot alone	One wild radish grown in a pot with 5 wheat plants
Height to first flower	27.8 cm	38.1 cm
Final plant dry weight	21.8 g	9 g
Total number of seeds	698	321
Germination at 14 days	25.8%	19.8%

Crop competition is a good thing. It makes the radish grow taller, enabling a better result with harvest weed seed control, and competition from crop plants suppresses weed growth. This pot trial (Table 1) simulated 100 wheat plants per m<sup>2</sup>, which is at the low end of crop density in Australia. Other research has shown that increasing crop competition leads to even further suppression of weed growth.

### R and S radish performed the same

Despite the resistant wild radish being smaller than susceptible radish when grown in pots alone, there was no difference between the populations when grown in competition with wheat. Crop competition is still a great tool, it's just that it is similar between resistant and susceptible plants.



**The pot trial with five wheat plants (simulating 100 plants per m<sup>2</sup>) with one resistant wild radish shows wheat wins the competition battle hands down.**

### Fun fact – Wheat yields a lot more than wild radish!

A single wild radish plant, grown alone in a pot, yielded 4 g of seed. When five wheat plants were added to the pot with wild radish, the wild radish seed yield was halved, but the presence of wild radish had no effect on wheat yield (Table 2).

**TABLE 2: Wild radish and wheat seed yield (g/pot)**

	Radish seed yield per pot	Wheat seed yield per pot
One wild radish grown in a pot alone	4 g	
Five wheat plants and one radish grown in a pot together	1.9 g	31 g
Five wheat plants grown in a pot alone		31 g

### To sum up

Merv and Mitch have the same bowling average despite one being much fitter than the other. 2,4-D resistant wild radish appeared to be less fit than susceptible wild radish but they both suffered the same fate at the hands of crop competition.

This research found that while there was no difference in the effect of crop competition on resistant or susceptible wild radish, crop competition is still a powerful tool.



# Genetically engineered moth could herald new era of insect control

**A** NEW study reports a successful, first-ever open field release of a self-limiting, genetically engineered diamondback moth (DBM), stating that it paves the way for an effective and sustainable approach to pest control.

The diamondback moth, also known as *Plutella xylostella*, is highly damaging to brassica crops such as canola, cabbage, broccoli and cauliflower. This new strain of diamondback moth, developed by Oxitec Ltd, is modified to control pest DBM in a targeted manner.

The study showed the engineered strain had similar field behaviours to unmodified DBMs, with results offering promise for future protection of farmers' brassica crops.

The Cornell study was led by Professor Anthony Shelton in the Department of Entomology at Cornell University's AgriTech in New York and has been published in *Frontiers in Bioengineering and Biotechnology*.

Oxitec's self-limiting DBM is modified to control its pest counterparts in the field. After release of males of this strain, they find and mate with pest females, but the self-limiting gene passed to offspring prevents female caterpillars from surviving.

With sustained releases, the pest population is suppressed in a targeted, ecologically sustainable way.

After releases stop, the self-limiting insects decline and disappear from the environment within a few generations.

## A win-win for pest control

The field test builds on previously published work in greenhouses by Anthony Shelton and colleagues that demonstrated sustained releases of the self-limiting strain effectively suppressed the pest population and prevented resistance developing to an insecticide – a win-win situation for pest control.

"Our research builds on the sterile insect technique for managing insects that was developed back in the 1950s and celebrated by Rachel Carson in her book, *Silent Spring*," reports Anthony. "Using genetic engineering is simply a more efficient method to get to the same end."

## Male moths as a crop protection solution

Employing field and laboratory testing, as well as mathematical modelling, the researchers gathered relevant information on the genetically engineered strain of DBM, whose wild counterparts cause billions of dollars in damage.

The study was the first in the world to release self-limiting agricultural insects into an open field.

"For the field study, we used the 'mark-release-recapture' method, which has been used for decades to study insect movement in fields. Each strain was dusted with a fluorescent powder to mark each group before release, then captured in pheromone traps and identified by the powder colour and a molecular marker in the engineered strain," explains Anthony.

## Moth-proof results

The researchers were very pleased with the results of this comprehensive study.

"When released into a field, the self-limiting male insects behaved similarly to their non-modified counterparts in terms of factors that are relevant to their future application in crop



**Dr Neil Morrison, from Oxitec, says the 'self-limiting' insect population technology has immense potential.**

protection, such as survival and distance travelled. In laboratory studies they competed equally well for female mates," reports Anthony.

"Our mathematical models indicate that releasing the self-limiting strain would control a pest population without the use of supplementary insecticides, as was demonstrated in our greenhouse studies.

"This study demonstrates the immense potential of this exciting technology as a highly effective pest management tool, which can protect crops in an environmentally sustainable way and is self-limiting in the environment," says Dr Neil Morrison, Oxitec's agriculture lead and study co-author.

**For more information see:**

<https://www.frontiersin.org/articles/10.3389/fbioe.2019.00482/full>

**Contact Anthony Shelton/Samara Sit: Email [Samara.Sit@cornell.edu](mailto:Samara.Sit@cornell.edu)**



**Greenhouse studies – and now a first ever open field trial – indicate that releasing the self-limiting genetically engineered strain of diamondback moth would control a pest population without the use of supplementary insecticides. This work may have paved the way for an effective and sustainable approach to insect pest control.**

# Russian wheat aphid in Australia: Building a crop risk profile

**T**HE more Australian researchers learn about Russian wheat aphid (RWA), the more confident they are that the pest does not pose a major threat to winter cereal crops in this country if growers and advisers understand how to manage it effectively.

Scientists have been studying RWA under southern Australian conditions and within local farming systems since it was first detected in 2016.

Through research investments by the Grains Research and Development Corporation (GRDC), a biological and ecological profile of the pest is being built to provide Australian grain growers with scientifically robust management tactics for the future.

RWA is now present in many grain cropping areas of South Australia, Victoria, Tasmania and New South Wales. Despite the ongoing dry conditions in northern NSW, surveys as recent as November 2019 have detected RWA as far east as Tamworth.

The aphid has not been detected in Western Australia, the Northern Territory or Queensland.

## Determining regional thresholds

The GRDC investment, 'Russian wheat aphid risk assessment and regional thresholds', was established to investigate regional risk and management options for RWA. The collaborative investment is being led by the South Australian Research and Development Institute (SARDI), the research division of Primary Industries and Regions SA (PIRSA), in partnership with sustainable agriculture research organisation, cesar.

The regional thresholds aspect of this research has involved capture of data from a series of trials across south eastern

Australia, which are operated by a number of farming systems groups.

Maarten van Helden, a SARDI entomologist, says the data on infestation levels, symptoms and associated yield will help to determine the regional production risk posed by RWA and the economic thresholds that will guide growers in effective management of RWA, taking into account infestation date, crop type and regional climatic conditions.

Maarten and his SARDI colleague, Thomas Heddle, discuss the research in a new GRDC YouTube video, available at <http://bit.ly/2QxUMNN>

"Currently, Australian intervention threshold recommendations are based on overseas research which recommends a spray application when more than 20 per cent of all seedlings are infested up to Growth Stage 30 and more than 10 per cent of tillers are infested from Growth Stage 30," Maarten says.

The Australian trials so far have shown that a considerable amount of RWA population pressure is required before yield loss is incurred.

In one of the untreated trial plots at Loxton in SA, almost 30 per cent of tillers were infested with aphids, enabling yield loss data to be recorded.

According to Maarten, the impact of that infestation was surprising: "Despite this heavy aphid attack, the plants were still able to grow and produce normally.

"Overall, yield loss in our trials has not been as high as expected when aphid numbers have largely been above the overseas threshold. It seems that the overseas thresholds are, at this stage, acceptable for affected Australian grain growing regions.



PIRSA SARDI researchers Thomas Heddle (left) and Maarten van Helden using Berlese funnels to extract Russian wheat aphids from grass samples, to assess where the aphids over-summer. (PHOTO: GRDC)



"Plants under drought stress are more vulnerable to aphid infestation and we have recorded yield loss in such situations.

"But with the results we are getting from these trials, we can now be quite confident in saying that in many situations there is minimal risk of Russian wheat aphid building up to damaging populations under Australian climatic conditions."

### RWA survival over summer

The GRDC investment is also investigating how RWA survives over summer. This knowledge is considered pivotal in determining the risk of infestation for winter sown cereals and potential damage ahead of each new cropping season, as well as aiding RWA management planning and development of cultural controls.

This work is discussed in a GRDC podcast, 'Just how many Russian wheat aphids is too many' (<http://bit.ly/2TxL2T7>), and another GRDC video, 'RWA green bridge surveillance' (<http://bit.ly/34h9Nb7>).

The current research effort builds on previous GRDC investments conducted by SARDI and cesar, which focused on seasonal factors influencing RWA population growth, biotype confirmation, varietal susceptibility, damage and yield loss, and chemical efficacy.

Research will culminate with an update of the GRDC RWA *Tips & Tactics* guide, which can be found at <https://grdc.com.au/TT-RWA>. Growers and advisers will also have the opportunity to keep up to date with the research through fact sheets, research updates, newsletters, webinars and trial site visits.

In the meantime, further information on RWA management is contained in the *Russian Wheat Aphid: Tactics for Future Control* publication, available at <https://grdc.com.au/rwa-tacticsfuturecontrol>, as well as I SPY, a comprehensive crop insect identification manual, which can be viewed at <https://grdc.com.au/I-SPY>

A RWA resource portal (including a regularly updated aphid distribution map, updates on current research efforts and the latest RWA management advice) hosted by cesar is available at <http://bit.ly/2Px67tu>. A cesar-produced Pest Bites video on identification of RWA can be viewed via <http://bit.ly/2N7uwIG> ■



Scientists have been studying RWA under Australian conditions and within local farming systems since it was first detected in 2016. (PHOTO: Maarten van Helden)



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# New optical sprayer 'sees' better and cheaper weed control

**T**HE Guest family uses a Weed-It Quadro optical spot sprayer to limit chemical build up and deal with troublesome weeds on 'Thorburn', their farm north of Griffith in southern NSW.

Rodney and Leonie Guest are the owners of the 2400 hectare property, which mainly produces wheat, barley, and peas. Their daughter and son-in-law Tanaya and Sandy Nixon live on the farm. It is Sandy who operates the Weed-It.

The soils on Thorburn are Mallee sandy loams with some sandy rises that have lower organic carbon levels. Rodney says they were finding residues of Roundup and 2,4-D building up in those low carbon areas, which limited following crops.

Legumes and canola are sensitive to spray and could not be planted on the sandier soils. To reduce the amount of chemical they use – and therefore residue levels – is one reason why they decided to purchase the Weed-It Quadro.

The Quadro is the latest version of the Weed-It. It has new blue light sensors every metre along the boom and each sensor controls four nozzles. When it 'sees' the green of vegetation it directs spray solely at that weed.

## Huge chemical reduction

The result has been a huge reduction in the amount of chemical they require.

Part of the farm rotation is to leave 400 hectares in fallow. This serves as a weed break and also conserves moisture for the next crop. Sandy sprayed the fallow land, just after getting the Quadro in September, 2019.

"I used just 25 litres of chemical spot-spraying, compared to 1000 litres if I had sprayed it all. There are huge savings to be made," Sandy said.

He says cutting down the amount of spray the family uses

is good for the soil, the environment, and the back pocket. In an increasingly regulated industry, it's all a positive, especially reducing the use of 2,4-D.

"It is a big advantage being able to use less chemical. We can afford to use more expensive chemicals that better target a troublesome weed. One of our problem weeds is feathertop Rhodes grass. Last summer to control it, we went out in utes most of the summer and chipped it out by hand.

"Now we are going to use the Quadro as we can afford a more expensive chemical, which has to go on at high rates."

## Spot spraying to help curb resistance build-up

Sandy also hopes the Quadro will delay the development of herbicide-resistant weeds. At the moment they are just starting to see resistant ryegrass and they are hoping to get on top of it by spot spraying during the fallow rotation.

The Quadro has two tanks so it can blanket spray and spot spray at the same time. The main tank is 4000 litres and the hot tank for spot spraying is 1100 litres. Other models available include the Weed-It 7000 with a 7000 litre main tank and 1500 litre hot tank.

The two tanks can hold different chemicals and spray at different rates.

Sandy has yet to use this feature, but says in future he plans to spot spray weeds whilst blanket spraying pre-emergents.

"It gives us options. If a paddock is clean we can do the whole paddock at a low rate and if there is a scattering of weeds we can give them a bigger hit."

When he is only spot spraying, Sandy uses the main tank for extra water. This means he does not have to make up as much spray at once.

He operates the Weed-It at 15 to 20 km per hour. It has a 24 metre ground-gliding boom, so he can cover lots of ground in a day. Boom width on the larger Weed-It 7000 is 36 metres.

The Weed-It system of sensors can be added to any type of sprayer. The Guests purchased their trailed Weed-It Quadro through their local Croplands dealer in Griffith.

They have also had plenty of support from Croplands.

"The Croplands reps have been fantastic. When we first got it a rep stayed with me for three quarters of a day to make sure I was confident. I have had three visits from them so far. I can't fault them."

The Guests knew of Weed-It sprayers because three neighbouring farmers have them.

"One neighbour said he had saved \$35,000 in the first six weeks using less chemical. When we went to purchase ours the Quadro was just released."

This newest Weed-It trailed sprayer from Croplands has boom recirculation. Sandy says the boom holds about 100 litres and with the new system he can flush it back into the tank so he is not wasting spray. Then he can turn it off and flush out the nozzles with clean water.

The blue light is more sensitive than red light, which is what many other sprayers use. "Blue lights are on the far end of the light spectrum so they do not get as much interference from daylight compared to the earlier red light sensors," Sandy says. ■



Sandy Nixon with his new Weed-It Quadro 4000.



## New generation sprinkler

**S**PRINKLERS clogging due to high silt volume in the water has been an old issue in Lootens Farm, located in Idaho, US. Farm owner Challen Lootens said, "it's a decade-old problem that we've experienced on these high-silt ditches that we're dealing with here. A lot of our water is very dirty, and it's always a problem."

Challen was using rotating sprinklers that were plugging regularly, stating "it was difficult to keep them cleared out and sometimes not be able to notice that you'd had a plugging issue until you harvested and realised you had a huge circle in your field that was dry, and it became pretty expensive," he added.

Challen tried different types of rotating sprinklers before installing the next generation i-Wob2s with 10-psi pressure regulators on his centre pivot. "We chose to switch to i-Wob2s because we'd heard good things and I've seen a lot of guys out here going with that nozzle, and it seems like they've been getting good results," he said. "So far, what I've seen with these i-Wob2s is they seem to handle the silt much better."

In addition to fewer plugging issues, Challen started to see other benefits.

### New sprinkler design – higher yields

"I know that I had some of the best yields ever last year on corn, after switching to i-Wob2s. And as a result, increased revenue," said Challen

"Like rain that comes from raindrops, the sprinklers seem to soak better. I think that the product has helped result in better yields overall and better application of our water and fertiliser."

"I'm having to use less water overall. I'm losing less from evaporation. And since using the product, it seems to have reduced the amount of overall time that I have to run my machines resulting in less power usage as well as less wear and tear on my pivots and gearboxes.

"Being able to easily switch nozzles is one feature that I really liked about them. It's very easy to unplug them if you ever do have a minor issue and if you need to resize a nozzle, the new i-Wob2s have a cover on the top that allows the sprinkler to carry up to three different size nozzles. So, if you had one spot that needed a little bit more water or a little less, it's a very easy and convenient way to adjust that and switch out nozzles."

For more information contact Martin Porter, E: [martin.porter@senninger.com](mailto:martin.porter@senninger.com)  
Ph: 0421 880 860.



The new i-Wob2s sprinkler helped reduce water use while increasing yields.

## Better handling seed treatment

**M**ANY seed treatment products can have a similar performance, but it's those that handle better that especially appeal to Western Australian farmer Tom Patterson. "It just makes life easier," said Tom, who farms with his brother, Digby, and their father, Chris, at Woodanilling in the state's Great Southern region.

The family continuously crops 70 per cent of their property mostly to a rotation of wheat, barley and canola.

The Pattersons previously used tebuconazole seed treatment fungicide but have since switched to Rancona Dimension. They treated all of their cereal seed for the first time in the 2019 season for full protection and peace of mind.

"We were thinking about another seed treatment, but then we heard of significant handling issues – dust and blocking up of augers and air seeders," Tom said. "Rancona Dimension doesn't do either of those. It keeps everyone happy."

The family used thiamethoxam with the Rancona Dimension on barley in 2019 for insect control and it also handled well, in contrast to other insecticide seed treatments previously used.

### A unique formulation with low dust-off

A unique micro-emulsion (ME) formulation provides the extremely low dust-off with Rancona Dimension at application, as well as easy clean down of machinery compared with other products. It also provides for better distribution of the fungicide and contact with pathogens.

Comprising two powerful active ingredients, ipconazole and metalaxyl, Rancona Dimension offers premium protection against crown rot and rhizoctonia root rot, as well as control of smuts, pythium and bunt in wheat, barley and oats. Combined with excellent seed safety, it allows faster emergence, ideal seedling establishment and healthier and more vigorous plants.

The Pattersons applied the fungicide at 3.2 litres per tonne and sowed their wheat and barley at 80 kg per hectare. Tom said combined with their crop rotation – which was helping to limit disease pressures – since using Rancona Dimension they had not encountered any major disease issues.

"We don't sow wheat-on-wheat, hence we don't put the seed dressing under pressure. We don't see a lot of crown rot in our crops now: Healthy plants resist diseases better," he said. ■



Chris, Digby and Tom Patterson during the 2019 harvest on the family's property at Woodanilling, Western Australia.

# Innovative program to help manage low growing season rainfall

**G**IVEN much of Australia's canola is dry sown, before the true amount of growing season rainfall is known, growers welcome any opportunity to reduce the risk of planting what can be a lucrative crop in the right conditions.

With 2019 producing another dry season for much of Australia, it reinforces that an enhanced program to help manage the risk of low growing season rainfall in canola would be a welcome addition.

The DecilePro program from Bayer is triggered when Roundup Ready canola growers receive a growing season rainfall (May to September) of decile 2 or lower and gives participating farmers credit to spend on Bayer products the following season.

Head of Customer Marketing for Bayer Crop Science in Australia, Tony May, says with tough conditions impacting much of Australia in recent seasons, the DecilePro program was a logical step.

## No downside

"If dry conditions result in low yields, growers who have opted in can use credits from the DecilePro program, off-setting some of that lost income," he explains.

"There is no down-side to getting into the program, it's a tool to help manage low growing season rainfall, and every grower of TruFlex canola or Roundup Ready canola is automatically able to use the program – there is no extra cost, growers just need to opt-in."

The process begins when a farmer purchases their TruFlex or Roundup Ready canola seed. Through their seed reseller, the farmer then opts in to the DecilePro program, which involves providing GPS points through their Technology Service Provider (TSP).

If the season is a low rainfall year – meaning decile 2 or below, or in the bottom 20 per cent of the past 10 years – the participating farmer receives a credit of 30 per cent of the



**Bayer's Tony May says this new program helps canola growers plan their season with more confidence.**

Roundup Ready canola or TruFlex canola technology fee to spend on Bayer product the following season.

## Based on your own farm's rainfall deciles

Tony says a critical aspect of the DecilePro program is that the rainfall deciles are unique to each grower's farm.

"GPS points provided when opting in to the program will be used to calculate each grower's unique rainfall decile trigger from the Bureau of Meteorology's five square kilometre grid," he says.

"Deciles are calculated on each participating grower's most recent 10 years of rainfall – meaning it's specific to every farm."

DecilePro is included in every kilogram of TruFlex canola and Roundup Ready canola seed sold, all growers need to do to be eligible is provide their GPS points to their TSP before April 15 and provide the relevant details.

"Farmers who receive decile 2 rainfall or below are unlikely to produce a reasonable harvest, so the DecilePro program helps them to reduce the risk of low growing season rainfall by giving them a credit if the rain doesn't come," Tony explains.

## The TruFlex technology

The enhanced DecilePro program comes following the first year of TruFlex canola commercial use in Australia, Bayer's second-generation weed control trait.

The TruFlex canola technology delivers a wider spray application window for Roundup Ready herbicides, extending past the six-leaf stage to first flower, as well as more robust rates, with warranted crop safety.

"Farmers can maximise yield potential through the TruFlex and Roundup Ready canola systems, and they can do so with the certainty that if they receive low growing season rainfall, the DecilePro program will help mitigate some of the costs of production," Tony says.

"When combined with the TruFlex technology, growers can plan with confidence, knowing they have a rebate in place should the season not turn out as hoped."

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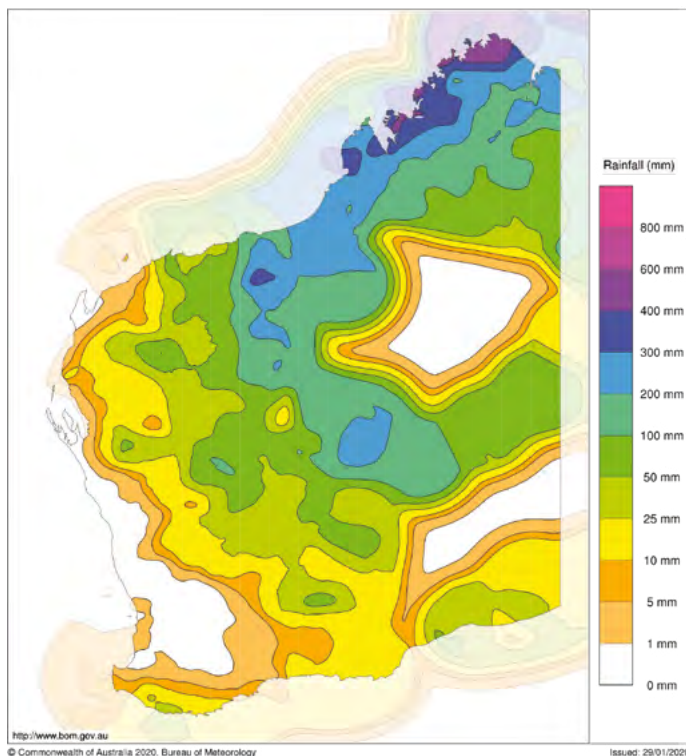
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# Western region

Western Australia rainfall totals (mm) January, 2020  
Australian Bureau of Meteorology



Some cyclone activity in January 2020 brought good rains to the north of the state but the southern cropping regions have had a typically dry start to the year.

## WESTERN AUSTRALIA SUMMARY

Winter crop prospects in Western Australia in 2019 appeared reasonable at the beginning of spring but deteriorated quickly. After below average winter rainfall and a late break to the season, crops needed average September rainfall to reach average yields. But unfortunately below average spring rainfall fell in most cropping regions, accompanied by well above average temperatures.

Heat stress and low moisture adversely affected most winter crops, especially in northern cropping regions such as Geraldton. Frost events during spring in the southern cropping areas reduced yield prospects for some wheat, barley and canola crops.

Winter crop production is forecast to have fallen by around 35 per cent compared to 2018 to about 11.6 million tonnes.

### WINTER CROP ESTIMATES, WESTERN AUSTRALIA, 2019–20

Crop	Area '000 ha	Yield t/ha	Production kt	Area change %	Prod. change %
Wheat	4,400	1.36	6,000	-6	-41
Barley	1,650	2.24	3,700	14	-25
Canola	940	1.01	950	-22	-35
Lupins	350	1.00	350	-8	-42

Note: Yields are based on area planted. Area based on planted crop that is harvested, fed off or failed. Per cent change are relative to last year.

ABARES, December 2019

# District Reports...

January–February 2020

## Southern region

### SOUTH AUSTRALIA SUMMARY

Seasonal conditions were mixed during the 2019 spring in South Australia. Crop prospects in most northern cropping regions were adversely affected by below average rainfall and above average temperatures during spring. But while spring rainfall was below average in parts of the upper Eyre Peninsula, the southern Mallee and the mid-North, it was timely, and benefitted yield prospects in these regions.

Average rainfall in September and the timeliness of rainfall in October supported average yield prospects in most southern cropping regions including lower Eyre Peninsula, lower Yorke Peninsula and the South East.

Fires in Yorke Peninsula in late November delayed harvest and reduced production in the region. But the affected region is a small proportion of total planted area in SA.

Winter crop production in South Australia is estimated to have increased by 19 per cent in 2019–20 to around 6.3 million tonnes. But production in 2018–19 was very low and forecast production in 2019–20 is still 15 per cent below the 10-year average to 2018–19.

### WINTER CROP ESTIMATES, SOUTH AUSTRALIA, 2019–20

Crop	Area '000 ha	Yield t/ha	Production kt	Area change %	Prod. change %
Wheat	1,950	1.79	3,500	5	19
Barley	845	2.19	1,850	3	21
Canola	220	1.36	300	10	15

Note: Yields are based on area planted. Area based on planted crop that is harvested, fed off or failed. Percent change are relative to last year.

ABARES, December 2019

### VICTORIA SUMMARY

Seasonal conditions were mixed in Victoria during spring after winter conditions were generally favourable. Timely rainfall and average daytime temperatures in September supported grain formation in most parts of the southern Mallee, the Wimmera, the North Central and the Western districts. Rainfall was below average and daytime temperatures above average in October for these cropping regions.

But average night time temperatures and sufficient levels of soil moisture supported average to above average yields.

In contrast, soil moisture levels were low at the beginning of spring in the northern Mallee and the north eastern parts of the Victorian cropping region, and yield prospects were adversely affected by below average rainfall and above average temperatures during spring.

High fodder prices and frosts in September caused some cereal crops intended for grain production to be cut for hay, especially in the northern Mallee and the north eastern parts of the Victorian

# District Reports...

January–February 2020

cropping region. Rainfall and cool conditions in early November delayed harvesting in most cropping regions, and helped to boost yields in late finishing districts.

Winter crop production in Victoria is forecast to increase by 92 per cent in 2019–20 from low levels in 2018–19 to around 7.2 million tonnes, which is 12 per cent above the 10-year average.

## WINTER CROP ESTIMATES, VICTORIA, 2019–20

Crop	Area '000 ha	Yield t/ha	Production kt	Area change %	Prod. change %
Wheat	1,450	2.48	3,600	4	85
Barley	800	2.88	2,300	4	109
Canola	385	1.61	620	28	107

Note: Yields are based on area planted. Area based on planted crop that is harvested, fed off or failed. Percent change are relative to last year.

ABARES, December 2019

## VICTORIAN MALLEE

Dry and warm conditions towards the end of spring resulted in crops ripening quickly and consequently growers in the northern Mallee started harvest in October. Conditions throughout harvest remained mostly favourable with headers being pulled up on the code red extreme fire danger day in late November as well as a number of total fire ban days. Despite this, most growers had wrapped up harvest before Christmas.

In some situations, contractors were engaged to get high value crops (canola, lentils) off before damage was done and the volume of grain people had to harvest.

Damaging winds during late November saw canola losses in crops not yet windrowed and extensive head losses in some barley varieties of between one to two tonnes per hectare. But



A windy November caused head losses in some barley crops bring yields back as much as 2.0 tonnes per hectare. But any livestock took full advantage of their grazing 'windfall'!

on the bright side, the fallen barley heads presented a grazing opportunity on mixed farming enterprises which recovered grain value via livestock.

Yields across the Mallee were extremely varied this season. Growers in the north harvested yields well below average with some crops not worth putting the header through.

The southern Mallee saw a different story thanks to stored soil moisture. Some growers around Birchip harvested farm record-breaking crops. Average yields were 3.0–3.5 tonnes per hectare in wheat, 4.0 tonnes in barley, 2.0 tonnes in canola and 1.5 tonnes per hectare in pulse crops.

Grain prices across the board have remained above average post harvest. But some growers are storing pulses and waiting for prices to rise further. Anecdotal reports about grain quality suggest some low oil content in canola but this varies across the region.

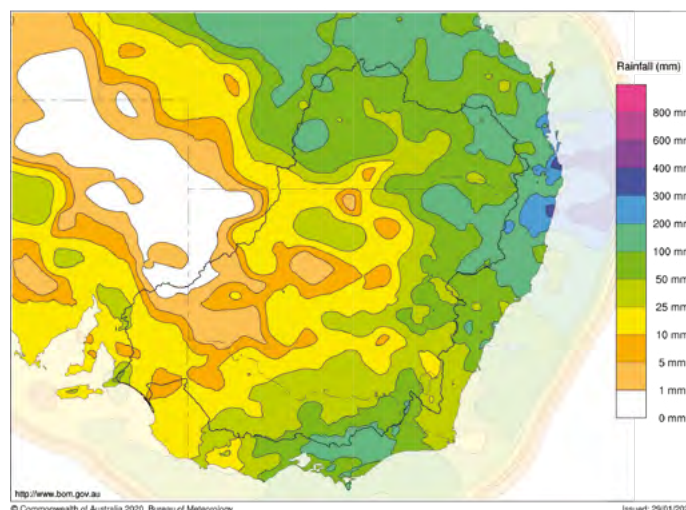
In high yielding areas crop straw is being cut and baled in an effort to prepare paddocks for sowing and to supply a very strong hay market.

As we enter the New Year there is still plenty happening on-farm. Many grain growers have been summer weed spraying after some summer showers and there is plenty of planning underway for the coming winter crop season. With minimal stored soil water at this stage, planning for the season is tending toward the lower risk crop options. Mixed farmers are busy with shearing.

Brooke Bennett  
Birchip Cropping Group  
January 16, 2020

## Murray–Darling Basin rainfall totals (mm) for January 2020

Australian Bureau of Meteorology



The month of January has brought some long-awaited rainfall to many northern cropping areas of the M-D Basin.

## Northern region

### NSW SUMMARY

Less than half of average rainfall fell in New South Wales from January to October 2019, the lowest for the first 10 months of the year since 1940. While spring rainfall was forecast at the beginning of spring to be below average, conditions that eventuated in many cropping regions were worse than expected.

The prolonged period of well below average rainfall had a significant impact on crop production in New South Wales.



# District Reports...

January–February 2020

Winter crop production in New South Wales is estimated to be at around 3.6 million tonnes in 2019–20, around 65 per cent below the 10-year average to 2018–19. Many crops intended for grain and oilseed production were cut for hay during spring in response to high fodder prices and uncertainty about enough spring rainfall falling to keep crops viable.

## WINTER CROP ESTIMATES, NEW SOUTH WALES, 2019–20

Crop	Area '000 ha	Yield t/ha	Production kt	Area change %	Prod. change %
Wheat	1,900	1.20	2,280	6	27
Barley	580	1.25	725	-3	15
Canola	250	0.90	225	32	48

Note: Yields are based on area planted. Area based on planted crop that is harvested, fed off or failed. Percent change are relative to last year.

Summer crop prospects in northern New South Wales are extremely poor. Coming into 2020 soil moisture levels were extremely low following the prolonged period of well below average rainfall

ABARES, December 2019

## QUEENSLAND SUMMARY

Winter crop production in 2019–20 is estimated to have fallen by 5 per cent to around 678,000 tonnes, the third consecutive year of falling winter crop production in Queensland since record

high production was achieved in 2016–17. If the estimate for 2019–20 is realised, this will be the lowest production since 1994–95, when 312,000 tonnes was produced.

Around 10 per cent of area planted to wheat and barley for grain production was cut for hay in response to high fodder prices and unfavourable seasonal conditions increasing the risk of grain production.

Seasonal conditions in southern Queensland and parts of

## WINTER CROP ESTIMATES, QUEENSLAND, 2019–20

Crop	Area '000 ha	Yield t/ha	Production kt	Area change %	Prod. change %
Wheat	400	1.05	420	0	5
Barley	45	1.33	60	-36	-37
Chickpeas	170	1.00	170	-15	-11

Note: Yields are based on area planted. Area based on planted crop that is harvested, fed off or failed. Percent change are relative to last year.

## Seasonal rainfall across the grain regions – 25 year averages and year to date

Brought to you in association with  JOHN DEERE	25yr Annual Average (mm)		2020 rainfall to date (mm)		Summer 25yr Annual Average (mm) 2019–20 to date		Autumn 25yr Annual Average (mm) 2019		Winter 25yr Annual Average (mm) 2019		Spring 25yr Annual Average (mm) 2019	
Emerald Qld	560		126		256	126	106	182	67	44	125	6
Toowoomba Qld	678		86		271	110	143	232	87	25	179	124
Roma Qld	567		97		245	107	118	133	74	18	131	35
Goondiwindi Qld	609		60		242	60	124	110	98	27	145	36
Narrabri NSW	617		99		213	106	121	111	122	15	161	60
Gunnedah NSW	622		48		206	50	110	144	125	28	182	38
Dubbo NSW	583		36		183	39	125	70	127	24	180	32
West Wyalong NSW	433		11		114	17	79	85	121	48	120	41
Wagga Wagga NSW	524		13		130	21	100	83	146	78	141	91
Swan Hill Vic	307		13		68	19	65	58	87	72	88	37
Bendigo Vic	491		50		96	54	107	78	159	139	129	81
Horsham Vic	365		52		73	56	72	66	121	133	98	58
Lake Bolac Vic	507		28		105	35	107	171	155	170	141	113
Murray Bridge SA	356		9		64	13	81	53	120	109	93	50
Kadina SA	328		6		59	19	79	70	108	76	82	59
Cummins SA	394		12		50	20	92	115	176	148	76	68
Esperance WA	620		19		91	23	137	103	253	248	138	97
Wagin WA	392		0		50	1	89	51	168	211	85	49
Northam WA	407		1		51	1	84	30	192	200	80	38
Mingenew WA	347		0		32	0	84	13	174	232	57	26
Moora WA	385		0		46	1	79	20	191	199	69	36
Mullewa WA	310		0		48	3	89	37	130	146	43	12

Last rainfall reading January 28, 2020.

# District Reports...

January–February 2020

central Queensland in September and October were generally poor. Rainfall was well below average in most cropping regions outside of small parts of the south east and central Queensland.

As in northern NSW, coming into 2020 prospects for summer crop production in Queensland are poor because of the long period of drought in most cropping regions. Average winter rainfall improved soil moisture levels north of Emerald to facilitate some planting of summer crops. Good rainfall in January has encouraged some late planting of sorghum and mungbeans while also lifting prospects for the coming winter crop.

ABARES, December 2019

## DARLING DOWNS

### Weather conditions

As I write this on January 17, there has been the start of some rain of what hopefully will be useful falls over the next 10 days. December yielded 10–20 mm rain generally with temperatures to 40°C leading to massive swimming pool evaporation and tough conditions for all crops.

### Summer crop

As at mid-January there are no dryland crops planted on the Downs. Irrigated crops are few and far between, and some of these have run out of water. The yields of these early crops will be well below normal irrigation expectations due to the dry conditions.



A very lonely irrigated sorghum crop on the Darling Downs this summer.

## ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

It is a late 1940s Lloyd restored by Mick Drew. Very rare in Australia.



By mid-January there were no dryland summer crops planted on the Darling Downs. But a very welcome change in recent weather patterns may just deliver sufficient rain to encourage some growers to plant before the 'window' closes in late February.

Some corn has been cut for silage, but mostly sorghum was planted. These crops are now at the early vegetative to desiccation stages. Weed pressure has been fair but heliothis pressure has been high. The cotton area is only 10 per cent of an average year.

Growers hope to still plant late summer crops if they can with sorghum planned until late January and mungbeans, corn for silage and millet to mid to late February.

### Winter crop outlook

Growers are planning on a month by month basis. Oats will be the first crop able to be sown and will probably be limited by seed supply. Barley and long season wheats may be planted early if there are opportunities, and the winter planting window is likely to be extended this year.

There is a real shortage of feed and a lack of stubble cover with the shortage of irrigation water and rainfall, so demand is likely to encourage a large planting of cereals over rotational crops such as chickpeas and faba beans.

**Hugh Reardon-Smith**  
Agronomist – Landmark, Pittsworth  
January 17, 2020

**Editor's note:** Some excellent rainfall in late January across the Darling Downs, northern NSW and other grain growing areas of the Northern Region has lifted spirits immensely for long-suffering growers hoping for a break in the drought.

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