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FRONT COVER

Avoid the burn

Grain growers are advised to take extra care with seed and fertiliser placement when confronted with dry sowing conditions. Dry soils increase the risk of harm to germinating seeds by fertiliser, especially when it is placed too close to the seed or at rates that are too high. See article page 6.
(PHOTO: Evan Collis)

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Northern Focus

Covering Northern NSW and Queensland

Disease Control. Simplified.

Cereals

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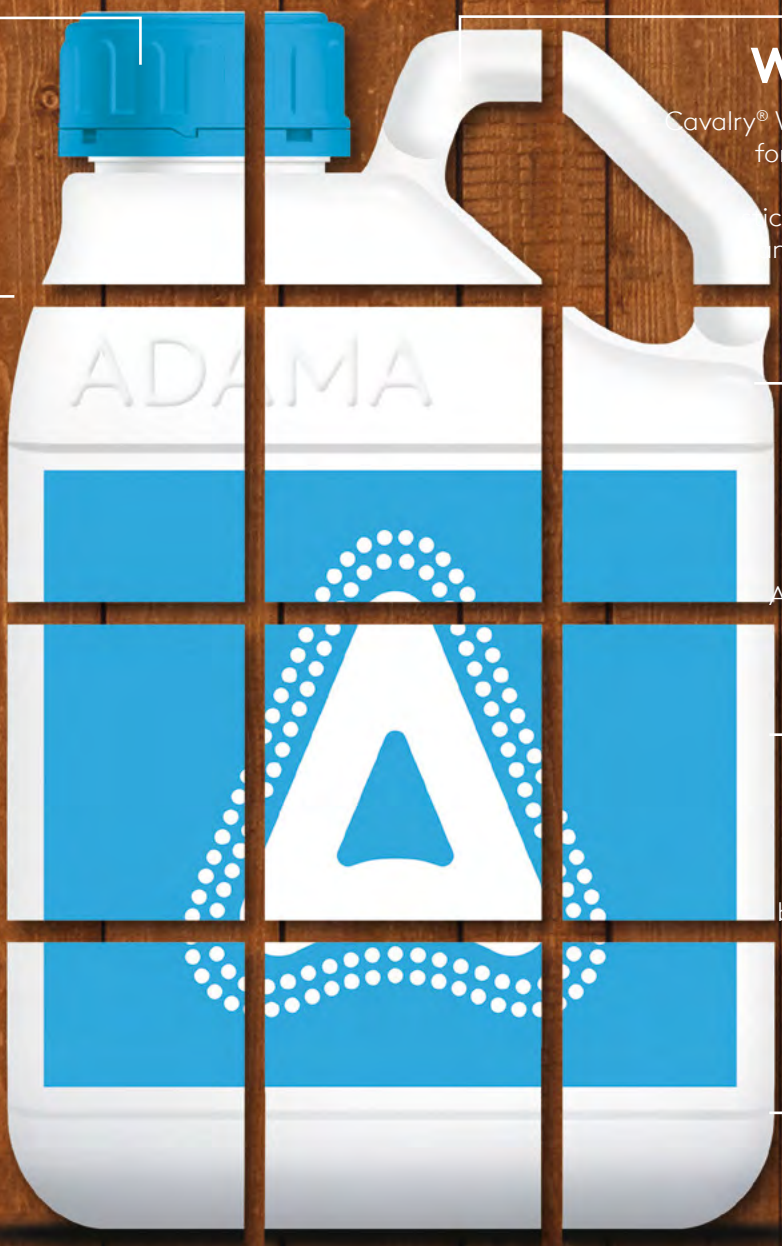

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Editorial... Lloyd O'Connell

USING the term 'normal season' in the Australian agricultural context really doesn't convey an accurate description of very much at all. Prices, costs, pests, yields and of course rainfall, are all seasonal variables bouncing around so much from district to district – even mailbox to mailbox – it makes the term little more than a convenient means of avoiding long-winded descriptions of what the season was really like.

Which brings us to the later than 'normal' start to this year's winter crop. It would take a big pair of oracles to accurately predict how the season might unfold from here and in turn, what ends up in the silo. Across the national grainbelt, the past two or three growing seasons have been anything but normal and they have produced an extremely mixed bag of harvest results.

Let's just say the season ahead looks like being one of those normal abnormal years where anything could happen.

From baiting mice to better rice

There's plenty in this issue to help you make every post a winner in the season ahead. With changing farming systems resulting in more crop residue, less livestock and ultimately a more stable food source for mice and other pests, mouse control has become an ongoing issue. We present the latest in mouse baiting techniques and strategies as well as an overview of how $4.1 million of your research levies will be invested in tackling this increasing problem.

We also take a look at weed control strategies in a season where there have been few opportunities for pre-sowing knock-down sprays or where pre-emergents have a tough job ahead.

Filling the inter-row space with a productive crop involves some novel and promising weed management research as does the advance towards more weed competitive wheat varieties.

Research is also showing that fertiliser strategies – at both sowing and in-crop – need some tweaking in late-starting seasons.

On the marketing front our Australian Export Grain Innovation Centre is doing a great job of identifying the grain quality attributes our export customers are demanding. In the face of increasing and fierce competition from the Black Sea region, it is imperative we are growing the product our customers want.

Rice production also comes under our spotlight with news of some unexpected Russian wheat aphid incursions while very clever Australian research has developed a non-GM salt-tolerant rice variety. This breakthrough looks like making some big domestic and global waves in not just rice but also the wider grains industry.

Still time to jump on a Greenmount farm tour

Six *Greenmount Travel* farm study tours are heading off to a wide range of intriguing and edgy destinations from early July through to late August. The southern Africa tour has filled up but if you're very quick, there is still time to jump on board one of these unforgettable tours. See *www.greenmounttravel.com.au*

Here's hoping for widespread rain to get the season rolling.

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In this issue...

JOHN DEERE

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Avoid the burn: Take care with seed and fertiliser placement

GRAIN growers are advised to take extra care with seed and fertiliser placement when confronted with dry sowing conditions. Dry soils increase the risk of harm to germinating seeds by fertiliser, especially when it is placed too close to the seed or at rates that are too high.

Agronomist Dr Rob Norton says growers need to be mindful of the soil conditions in their paddocks when applying fertiliser at sowing.

"The dry lead in to winter sowing in 2018 means last year's strategy might not be safe this year," says Rob, the director of Norton Agronomic.

Rob, who chairs the Grains Research and Development Corporation's eXtensionAUS crop nutrition community of practice, encourages growers to use a seed damage calculator, available at *goo.gl/NT8vmB*, to check how much fertiliser they can apply with seed through the same chute.

The calculator doesn't address fertiliser placed below or to the side of seed, but Rob says separation of seed and fertiliser at around three to five cm is usually enough distance to protect the seed.

"The risk of fertiliser damage increases with drier and sandier soils," Rob says.

"Conditions that cause stress or slow germination prolongs fertiliser-seed contact, and this increases the chance of damage."

Crop type is another factor, with canola and lentils being more sensitive, while wheat and barley are relatively tolerant.

Rob Norton says growers need to be mindful of the soil conditions in their paddocks when applying fertiliser at sowing. (PHOTO: Evan Collis)

The order of sensitivity for crop species can vary for fertiliser type, but in general, the order from most to least sensitive is:

- Canola;
- Lentils;
- Peas;
- Oats;
- Wheat; and then,
- Barley.

How fertilisers affect germinating seeds

Fertilisers can affect germinating seeds in at least two ways, with the first relating to salt index. Most fertilisers are salts and as such, too much fertiliser salt can 'burn' the seedling or stop seedlings from absorbing water.

Nitrogen and potassium fertilisers tend to have a higher salt index than phosphorus fertilisers. Sulphate forms tend to have lower salt indexes.

Ammonia formation potential is the second consideration.

Rob says free ammonia can be toxic to seed: "Placing urea-containing fertilisers in-furrow is risky because they produce ammonia.

"A fertiliser with polymer coatings or urease inhibitors may slow the rate of ammonia production enough to protect seed. These fertilisers are still considered risky to place near seeds."

In terms of placement, Rob says the safe rate of fertiliser per hectare increases as row space narrows. "Closer row spacing 'dilutes' fertiliser over the length of row."

Machinery configuration, such as twin chuting systems which separate seed and fertiliser, can assist in protecting the seed. Fertiliser is placed in bands to the side or below the seed bands, and separation of three to five cm is usually enough to protect seed.

Seed bed utilisation

Cowra based Incitec Pivot technical agronomist Jim Laycock says the more scatter there is between seed and fertiliser, the more fertiliser can be safely applied.

"The concept of seed bed utilisation (SBU) addresses this factor. SBU is the proportion of row width occupied by seed row, and with anything less than 10 per cent, particularly in canola you may have a problem," he says.

"It's the seed row width divided by the tyne spacing or row width – the wider the seed row for a specific row width, the greater the SBU. As SBU increases so does the safe rate of in-furrow fertilisation.

"Most growers are aware of this, but given the amount of dry seeding happening, it can be worthwhile double checking your SBU levels."

Tables for fertiliser/crop combination thresholds are available on the International Plant Nutrition Institute website at *http://anz.ipni.net/article/ANZ-3074*.

Rob says the seed damage calculator includes several liquid fertilisers.

"As a general rule, use the same maximum nitrogen or phosphorus rates as for solid products, based on nutrient concentration. Treat urea/ammonium nitrate like urea. Treat ammoniated phosphoric acid the same as MAP."

More information on seed and fertiliser placement in dry soils is available on the eXtensionAus website at *goo.gl/ZuYKPJ.* ■

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Growers urged to monitor and manage early weeds

WHILE many grain growers are looking anxiously for a break in the weather, experts are warning them to be vigilant about monitoring and managing early weeds this season.

GRDC Crop Protection Officer, North Vicki Green said as many growers have dry sown a proportion of their winter program there was now the potential risk of a weed blow out when it rained as pre-emergent herbicide effectiveness could be compromised by the dry start to the season.

"Growers trying to juggle large cropping programs will dry sow winter crops, but this has the potential to compromise weed management," Vicki said.

"This is further complicated when pre-emergent herbicides have been applied and dry conditions prevail. So we want to remind growers of the need to be prepared and monitor and manage for early in-crop weed control."

She also encouraged growers to be selective about the paddocks they do dry sow, favouring those that were kept clean last season or planting crop varieties that have a wide range of post-emergent weed control options.

Best practice pre- and post-emergent strategies

It is a position supported by ICAN weed specialist Mark Congreve, who is involved in a GRDC investment designed to improve grower and advisor understanding of best practice pre- and post-emergent herbicide application.

Mark said dry sown crops were likely to have weeds emerging with the crop, particularly if no pre-emergent herbicide was used.

"So these crops are likely to need an early post-emergent application," he said.

"My concern is that effective post-emergent herbicides are limited and need to be correctly timed, so leaving weed control 'until later' while other paddocks are planted may mean post-emergent herbicides are likely to be less effective. For example, if you want to target ryegrass in wheat and barley with Boxer Gold post-emergent then it has to be applied before the ryegrass reaches the three-leaf stage."

Mark said if growers had applied a pre-emergent herbicide and sown dry, how it performed would depend on:

- The actual herbicide used;
- Soil moisture at application;
- How well the herbicide was incorporated;
- The amount of rainfall received when the season eventually breaks; and,
- The depth from which the weed seeds were germinating (on the surface or from depth).

"Determining the effectiveness of pre-emergent herbicides in these conditions is difficult and varies depending on the situation," he said.

"But the message for growers who have already applied a pre-emergent with their dry sowing is really to monitor crops for early weeds and to be prepared to implement any additional control measures early for maximum effect."

Mark said growers should consult with their advisors to make informed decisions around the choice of post-emergent grass active herbicides to optimise their performance in the paddock.

He said understanding the resistance status of the weeds, the different modes of action available (herbicide biochemistry), how post-emergent herbicides enter the plant and what can be done to maximise uptake (formulation, application and adjuvants) was key to effective weed control in-crop.

For more information about how different pre-emergent herbicides may be affected by dry conditions go to *https://weedsmart.org.au/webinars/* ■

GRDC Crop Protection officer Vicki Green is encouraging growers to be selective about paddocks they dry sow this season and favour those that were kept clean last season or plant crop varieties that have a wide range of post-emergent weed control options.

Edible food wraps, that's a wrap!

By Dennis O'Brien, Agricultural Research Service – USDA

AT A GLANCE…

- Reformulated food wraps from casein, a milk protein.
- The films can enhance taste, appearance, and nutritional qualities of many food types including cereals.
- The films are made from milk proteins, are edible, and reduce waste.

SOME things seem to get better with time. Thanks to two Agricultural Research Service (ARS) chemical engineers in Wyndmoor, Pennsylvania, that could be said of the food coatings and films that one of them developed as food wraps more than 10 years ago.

The products, initially created by Peggy Tomasula, are made from casein proteins commonly found in milk. Tests by Peggy and colleague Laetitia Bonnaillie have since shown that the casein wraps are up to 500 times better at keeping oxygen out of food packaging than traditional petroleum-based wraps. Oxygen exposure is a major reason why foods spoil.

In recent work, they've shown that adding an alkali compound to the wrapping material makes it stronger; more resistant to humidity, temperature, and moisture; and 'stretchier', Laetitia says.

The material looks like most commercially available plastic food wraps, but because the casein wraps are made from milk proteins, they are edible.

"That feature adds to the material's appeal because it will reduce the amount of food-wrapping waste that goes into landfills," Peggy says. The edible films could be used to wrap individual foods that go inside an outer plastic bag or cardboard box, like cheese sticks. Single-serve snacks are becoming more popular, and they use up a lot of inner packaging, she says.

The scientists' edible films have been the focus of extensive news reports over the years, but the latest improvement (adding the alkali compound) is just one way that they've enhanced the product in the last decade. Other additives have included pectin, a natural food product that appears to form a fishnet-like network around the casein particles and makes for a stronger film.

So far, they've made the wraps into tea bag-like pouches to hold powdered soup and instant coffee, and they've made them more resistant to water and fat so they can be applied directly to cheese sticks and candies.

Can also be used with cereal products

The casein formulation can also be sprayed on dry cereals to replace sugar coatings, and it will keep the cereal crunchy in milk. The treatment also could add protein to the cereal, as well as colors and flavourings to enhance its appearance and taste, Peggy says.

The researchers' efforts at ARS's Dairy and Functional Foods Unit are paying off: The wrap is attracting considerable interest from the private sector, and the agency is pursuing its options in licensing the technology.

Because casein proteins are extracted from milk, there's no US Food and Drug Administration approval required for using them as a food wrap or an edible product. But ideally the films should be used with other dairy products, or labeled with an allergy warning if used with other foods, because milk proteins like casein are allergens.

Chemical engineer Peggy Tomasula and chemist Phoebe Qi inspect casein films made with a process Peggy helped develop. (PHOTO: Paul Pierlot)

The researchers plan to continue refining the film's process and formulation to make it more versatile.

"Our goal is to design edible films that can be used to protect food anywhere: in warehouses, on store shelves, in refrigerators or at room temperature, or even outdoors in hot and dry climates or humid areas," Laetitia says.

For more information:
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Laetitia Bonnaillie, Dairy and Functional Foods Research;
E: laetitia.bonnaillie@ars.usda.gov; Ph: +1 (215) 836 3782

■

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ASK AN EXPERT –

IS IT POSSIBLE TO APPLY ADDITIONAL COMPETITION TO INTER-ROW WEEDS?

With Hanwen Wu, Principal Research Scientist, NSW DPI

THE inter-row space provides an ideal environment for weeds to grow, particularly if pre-emergent herbicides are not applied or are less effective than expected.

NSW Department of Primary Industries principal research scientist, Dr Hanwen Wu says filling the inter-row space with a productive species might be another way to suppress weed growth and reduce seed production of herbicide resistant weeds.

"There is very strong evidence that narrower rows are an excellent way to increase crop competitiveness but there are some practical limitations," he says. "We have looked at a combination approach, of planting most of the seed in rows and the rest broadcast to 'fill in the gaps'. We have called this the 'compound sowing technique'."

The compound sowing technique

In 2016 Hanwen set up two field trials at different locations near Wagga Wagga, NSW to assess the effect of this system on weeds and crop yield in both narrow (22.5 cm) and wider (45 cm) row spacings, with and without IBS trifluralin. Three broadcast species were evaluated – wheat, gland clover and French serradella. The two sites were assessed to have an initial annual ryegrass density of 48 and 25 plants per m^2.

"We sprayed out the broadcast legumes in early September to prevent them competing with the crop for moisture," says Hanwen. "Further trials are needed to test a range of parameters such as suitable legume species, optimal seeding rates, proportion of seed broadcast, row spacing for the conventional seeding and different pre-emergent herbicide options."

Although the 2017 season did not allow Hanwen to replicate this trial he is keen to do more trials in 2018.

"We think this technique has merit and our initial trial suggested that weed suppression can be achieved without any yield penalty," he says. "There even seems to be situations where a yield increase can be achieved in response to reduced weed pressure."

Dr Hanwen Wu, NSW DPI is investigating new ways to increase crop competition, particularly in the crop inter-row space.

Using a broadcast legume that is sprayed out in September could have additional soil health and moisture retention benefits and warrants further investigation.

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CNH INDUSTRIAL CAPITAL

Compound sowing technique (conventional + broadcast sowing) dramatically increases crop competition in the inter-row compared to conventional sowing. Of the three broadcast species tested, wheat provided the strongest suppression on weed biomass.

Crop competition is rightfully attracting more attention from farmers and researchers in the war on herbicide resistant weeds. It is a numbers game and crop competition can play an important role in vastly reducing weed seed set.

Which was the most competitive broadcast species?

Short answer: Wheat.

Longer answer: At the weediest site the broadcast wheat treatment, without IBS trifluralin reduced annual ryegrass biomass by 71–77 per cent at both the narrow and wider row spacings. In the presence of less weeds the broadcast wheat still reduced weed biomass by 50 per cent in the narrow rows and 27 per cent in the wider row configuration.

IBS trifluralin further increased weed suppression at both sites and both row spacings. At the weedier site, annual ryegrass biomass was suppressed by 88–90 per cent. Where there were less weeds present, the addition of IBS trifluralin increased biomass suppression from 27 to 70 per cent at the wider row spacing.

What was the effect on yield?

Short answer: The wheat yield increased by 15–22 per cent at the weediest site when wheat was used as the broadcast species.

Longer answer: In the favourable season of 2016, only broadcast wheat generated a yield increase, and only in the presence of higher weed pressure. None of the broadcast treatments caused a yield reduction at either site. Further trials are required to evaluate the impact of site and seasonal climatic conditions on the weed control and crop yield associated with the compound sowing technique.

The broadcast legumes may provide additional soil fertility and moisture retention benefits while maintaining crop yields. More work is needed to identify more competitive legume species to have a greater impact on weed biomass and to identify the optimal timing to kill broadcast legumes to maximise weed suppression and minimise yield loss.

Have any farmers tried this idea?

Short answer: Yes.

Longer answer: Leigh Bryan at Swan Hill has tested this idea on his farm – he calls it zero-row spacing. Also in 2016, a strip-trial in barley resulted in the zero row spacing strip yielding 4.994 tonnes per hectare compared to 4.889 tonnes in the conventionally sown crop at 37.5 cm spacing. This was achieved with no pre-emergent or in-crop herbicide applied.

Leigh has noticed that the random placement of stubble is easier to sow through the next year and it still provides trellising for pulse crops and shades the soil to conserve moisture and reduce soil surface temperatures. ■

HOW TO ASK A WEEDSMART QUESTION

Ask your questions about crop competition on the WeedSmart Innovations Facebook page WeedSmartAU, Twitter @WeedSmartAU or the WeedSmart website *http://www.weedsmart.org.au/category/ask-a-weedsmart-expert/*

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GROWERS are one step closer to accessing wheat varieties that can compete better against weeds, particularly herbicide resistant annual ryegrass.

The first weed-competitive wheat lines were delivered to commercial breeders in April for preliminary yield and quality testing and, if successful, varieties may be available to growers within five years.

These have been developed as a part of GRDC investments to help growers protect wheat yields and reduce herbicide costs.

The cost to Australian agriculture from weeds is estimated at $4 billion annually in crop yield losses and seed contamination alone.

CSIRO research geneticist Greg Rebetzke said new genetics and an improved ability to predict plant traits had enhanced the development of genetics that were used as parents in the development of the new lines.

Farmers confronting a 'perfect storm'

"Increasing herbicide resistance, together with no new modes of herbicide action, are contributing to a 'perfect storm' in grain growers' ongoing battle against weeds," Greg said.

"Wheat is particularly vulnerable, with the commonplace use of glyphosate as a chemical control of annual ryegrass. It is poor control of ryegrass that makes wheat the weakest link in weed management in Australian cereal rotations.

"The aim of this research is to assist the development of weed-competitive wheats that can be used as part of integrated weed management strategies, adding another option to the grower's weed control toolbox.

"Currently there are few new herbicide technologies that will assist in managing weeds in wheat and dealing with herbicide resistance issues.

"But along with the use of appropriate agronomic management practices, the adoption of harvest weed seed collection and destruction technologies – and the careful management of any future new chemistries to prolong their effective life – competitive wheats have the potential to help control weeds and reduce costs to growers."

International collaboration

Researchers engaged closely with commercial breeders throughout the process to ensure the project delivered varieties that were the most commercially relevant to growers.

"Since 2005, weed-competitive breeding lines have been developed using the unique genetics from more than 30 overseas wheat varieties," Greg said.

"The collaboration between researchers and commercial breeders resulted in more than 7000 lines being sown in 2017 at the research facility at Yanco, New South Wales, with the first yield assessments of selected lines to commence in 2018 by commercial breeders.

"Greater early vigour and larger upper canopies have been reported both overseas and in Australia as characteristics important in crop competitiveness. These breeding lines have approximately double the leaf area of today's commercial wheat varieties.

"A noticeable feature of recent lines developed is larger flag and penultimate flag leaves (the leaves just below the ear of the plant)."

While the focus has been on increasing competitiveness through greater shoot growth, the project also aims to explore other below-ground opportunities, including a modified and more competitive root system.

The research has been conducted in collaboration with Dr Gurjeet Gill, of The University of Adelaide, Dr Bob French of the Department of Primary Industries and Regional Development (DPIRD) in WA and the weed ecology group led by Professor Leslie Weston at Charles Sturt University (CSU).

Information was presented earlier this year at GRDC Grains Research Updates. Greg's Updates paper is available by searching 'competitive wheat' at *http://www.grdc.com.au/updates*

■

CSIRO's Greg Rebetzke (centre) with AGT breeders Russell Eastwood and Brett Irons at the NSW DPI's Yanco breeding nursery. (PHOTO: CSIRO)

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Weed control is a package deal

By Cindy Benjamin, WeedSmart

AGRONOMIST Craig Davis has been assisting growers in the Mid North and Yorke Peninsula of South Australia to navigate their way around resistance to key herbicides such as trifluralin, Group A and Group B herbicides for 10 years or more.

"Some of this chemistry was cheap and dealing with the loss of these modes of action has been difficult," says Craig. "The key to farming without these herbicides has centred around using crop rotations to control the weed seed bank."

Annual ryegrass control has been and remains a significant cost to growers in these regions. Brome grass and wild oats are becoming increasingly important weeds that were previously suppressed by trifluralin, and stubble retention on many farms has also favoured some weeds, like brome grass.

Craig says these weeds are demonstrating increasing resistance to Group A (fop and dim) and Group B (SU and imi) herbicides, and some of the alternative pre-emergence herbicides are relatively ineffective, or variable in their control.

For some growers, oaten hay production for export has been a useful enterprise to reign in resistant annual ryegrass numbers. Although a very effective weed control option, it is not for everyone.

Brome grass and wild oats are not as well controlled through oaten hay production because a significant amount of seed is shed before the crop is cut.

Breakthrough came with imi-tolerant lentils

For many hard-to-kill weeds, a breakthrough came with the introduction of new imi-tolerant lentil varieties in the early 2000s, which are now built into the rotation on most farms in the region. "Imi-tolerant lentils have been very useful in managing weeds, and the high grain prices and suitability to the rotation have made them the legume of choice for growers," says Craig. "In practice though, field peas are the most effective legume option for grass weed control."

Field peas can be sown later without suffering a yield penalty, are a more competitive crop and are a good option for effective crop-topping due to their early maturity. The downside of field peas is the likely build up of snail numbers.

Break crops currently make up around 50 per cent of the cropped area, due mainly to the recent high price for lentils. Craig expects this area of break crop to drop in response to the lower lentil price, but growers generally recognise the benefits of maintaining diversity in their cropping program.

"Canola is more competitive than lentils and enables the use of triazine as an alternative chemistry for annual ryegrass control," he says. "Hybrid canola is particularly competitive against weeds and can suppress seed set even when the herbicide package is not strong."

A large portion of the canola crop is windrowed and there is a long history of spraying under the cutter bar to reduce seed set in lodged and late germinating ryegrass. Many growers have added narrow windrow burning (NWB) to their weed management program to kill any viable weed seed left at the end of the canola crop.

A cheaper option is to spray over the top to desiccate the crop, then direct harvest with a narrow windrow burning chute and burn the narrow windrows the following autumn, but Craig has witnessed significant wind damage to standing crops and recommends growers continue to swath and spray under the cutterbar, unless they can guarantee timely harvest. The higher harvest height of direct headed canola also means a significant amount of weed seeds are not captured in the header front.

Canola yield plateau

Canola grown on cereal stubble has reached a yield plateau, and along with the increasing incidence of clethodim resistance, Craig expects growers to increase their use of double-breaks in their rotations. The traditional double break in the area was pasture followed by canola, which provides annual grass weed control, a cereal disease break and uses the residual soil nutrients.

"There is now an increase in the use of a double break of oaten hay or grain legume followed by canola," he says. "This allows the canola to thrive in paddocks with lower weed burdens, lowers stubble residue levels and increases soil nutrient levels, particularly nitrogen."

"Adding feed barley to the rotation offers growers the opportunity to implement a triple-break to control brome grass,

GETTING STARTED WITH CHAFF LINING

Farming 4000 hectares of light sandy to heavy clay soil in the medium rainfall district of Halbury and Salter Springs SA, Kevin Simon trialled chaff lining for the first time in the 2017 harvest.

Kevin planted early maturing PBA Wharton field peas to help bring annual ryegrass numbers back under control. The field peas yielded around 3–4 tonnes per hectare and, being early maturing, offered an opportunity to harvest early and catch the ryegrass before it lodged or set seed.

"Harvesting low and early are important to stop ryegrass seed set but it also comes with difficulties because the ryegrass is still green and can bind up the rotors in the header," he says.

Kevin plans to plant TT canola into this paddock in 2018 using a disc seeder to minimise disturbance of the chaff line. With limited in-crop herbicide options available, Kevin relies on late season cultural control.

Late season weed control

"We spray over the top of the canola with a self-propelled sprayer then direct harvest to control ryegrass using the chaff lining chute," he says. "Chaff lining is also a good way to collect volunteer crop seed from the previous season. The plan is to place the canola narrow windrows on top of the previous year's pea chaff line, and burn the narrow windrows to control weed seeds collected during the harvest process."

Last summer was very dry and so there was very limited germination of volunteers and weed seeds from the field pea chaff lines. In wetter years, Kevin expects that volunteers would be the most dominant plant type within the chaff line, with ryegrass being the next most prevalent species present. If necessary, Kevin is prepared to apply a range of chemical and cultural control measures to target the weeds growing in the chaff lines.

wild oats and ryegrass, making use of the permit that allows spray-topping of feed barley to reduce weed seed set prior to harvest," he says.

Craig works with his clients to optimise crop competition in tandem with a good pre-emergent herbicide package. He says that effective and relatively cheap pre-emergent herbicides have previously masked the true value of crop competition.

"Stubble retention makes the adoption of narrow rows more difficult but many growers have moved from 30 cm to 22 cm row spacing using tyned planters," says Craig. "More commonly, growers are using higher planting rates to achieve stronger crop competition. The other critical aspect is to seed all crops at the optimal time of sowing and to not plant everything early. Early sowing should only be considered for paddocks with low weed numbers."

Mixing pre-emergents

Mixing trifluralin with another pre-emergent herbicide is an effective tool provided both herbicides in the mix have some efficacy – say over 80 per cent efficacy as a stand-alone herbicide. With high levels of trifluralin resistance now widespread, the use of other effective MOAs in combination is increasing. With heavy stubble loads on the soil surface making it difficult to achieve high levels of control using pre-emergent herbicides, Craig says it is essential that growers diversify and implement other weed control tactics to remove any survivors and stop seed set.

Harvest weed seed control has been widely accepted as a necessary tool to manage the seed bank. Narrow windrow burning (NWB) is commonly practiced in the region, mostly in canola and lentil crops because the windrows tend to stay in place and support a hot fire that achieves a high level of weed seed kill.

"There has been considerable interest in chaff management systems in the district and several clients have used chaff carts in the past," he says. "Now there are a few chaff decks operating and some growers are trialling chaff lining. There has been success with chaff lining pulses one year and placing the narrow windrows of the following canola crop on top of the pulse chaff line."

"Growers using chaff decks are seeing improvements in summer spraying efficacy as a result of less dust coming off the tramlines," says Craig. "The downsides are the increased difficulty in establishing crops in the tramlines and, although the weed seed mortality is high, there are still high numbers of weeds germinating on the wheeltracks."

For more information about implementing the WeedSmart Big 6, visit the Weedsmart website: *www.weedsmart.org.au* ■

Mid North SA agronomist Craig Davis says field peas are the most effective legume option for grass weed control in the Mid North and Yorke Peninsula region.

Weird – but clever!

By Ian M. Johnston

The eccentric Bulldogs

Frankly, I have absolutely no idea how many times I have embraced the subject of Bulldog tractors within the pages of my books and magazine articles. The main persuasive reason for so doing is that of all the tractors about which I have written, Bulldogs unequivocally have attracted the greatest interest. The same can be said when a Bulldog performs its thumping and jumping at a classic tractor field day. The spectators abandon the Fordsons, John Deeres, Chamberlains, and so on in favour of crowding around the idiosyncratic and highly entertaining Bulldogs.

Plus, I have to be perfectly honest, I too have a soft spot for these weird hunks of hardware, having experienced over six (yes six) decades of fascinating involvement with them.

In order not to complicate things, it is important to note that there were actually two manufacturers of Bulldog tractors offered to Aussie farmers. The original (and some say the best – including me) were those manufactured by Heinrich Lanz A.G. of Mannheim, Germany.

But during and for some years following World War 2, the importation of these Deutschland machines was temporarily terminated for obvious reasons, not the least of which was the destruction of the Mannheim plant, courtesy the US Airforce.

The principal importer of Lanz tractors prior to the outbreak of hostilities, was the Victorian firm of Kelly and Lewis Ltd. Armed with technical drawings and spare parts samples, they decided to produce a near identical replica of the Mannheim original. The KL board foresaw an excellent marketing opportunity during the postwar shortage of imported tractors.

Accordingly, KL Bulldogs finally entered the tractor market in 1949, three years behind schedule, on account of planning and development frustrations, of burlesque proportions.

I remove the steering column of a KL Bulldog in my collection.

The Chief Design Engineer Alios Murr suffered hours of frustration, arguing with management over cost issues which he claimed were jeopardising the integrity of the design. He referred to such matters as the inadequate thickness of the piston surface, the failure to heat-treat the crankshaft, the poorly constructed fuel tank, and so forth. In the end he resigned in disgust.

Thankfully the majority of the perceived weaknesses were addressed prior to the release of the product.

My initiation

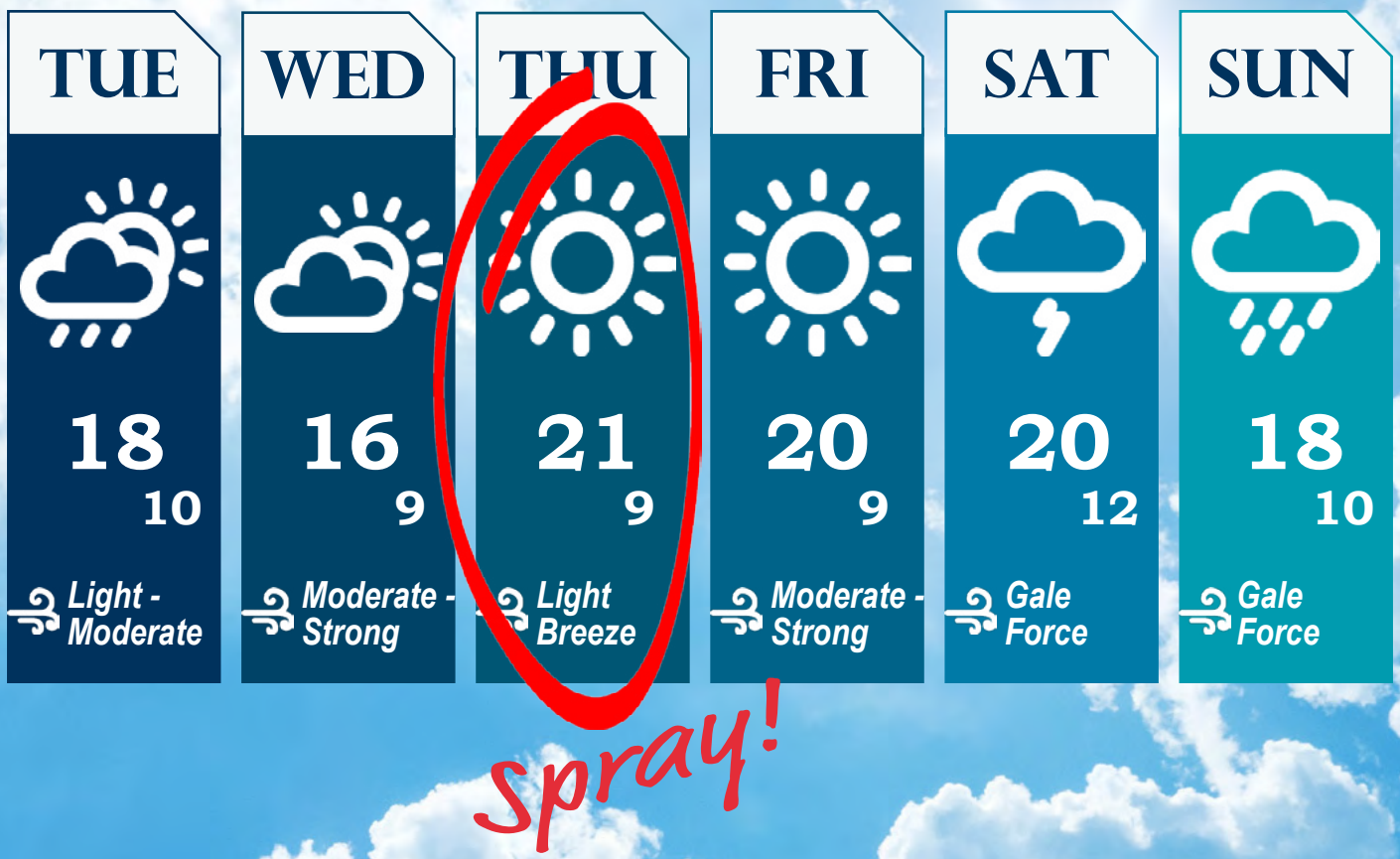
During a sweltering hot afternoon in late 1954, I was astride my Indian Big Chief motorcycle – complete with sidecar – into which were crammed all my worldly possessions, including Suzie my wee doggie mate. I hadn't sighted another vehicle for over an hour. Not surprising really – the Rowena to Burren Junction Road, even today, is not noted for its traffic jams.

I had just resigned from the job of a Windmill Assembler's Mate. Trying to bolt together a 100 foot tower, out in the hot arid New South Wales Western Plains with the temperature 110 in the waterbag, had suddenly lost its appeal. So Suzie and I were heading to Narrabri in the hope of obtaining a casual job as a tractor driver which – although would not pay as much as a Windmill Assembler's Mate – would undoubtedly increase my chances of one day achieving old age!

Then it happened! The rear tyre of the Indian punctured. With a groan I rolled the big machine to a stop and switched off the ignition. Silence, apart from the ticking of the cooling exhaust pipe. But not for long! Accompanied by a cloud of dust, an

Inserting the steering wheel assembly into the side flywheel.

WHEN YOU'VE ONLY GOT ONE CHANCE



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The fearsome blowlamp warming up.

Austin A70 ute pulled up behind me. A long gangly chap, his features hidden in the shadow of a large Chips Rafferty style hat, climbed out from behind the wheel.

"Ye orright mate?" he inquired.

His name was Trevor Ward and he was a share farmer returning to Narrabri from a machinery sale at Collarenebri. His offer of assistance was gratefully accepted. An hour later, with sweat pouring from each of us, the offending tyre was repaired.

But significantly, Trevor was seeking to employ a tractor driver and had a spare room in his Narrabri home, which for 15 shillings a week, including keep, would be mine during the next few months, should I accept his offer of a job.

The following morning, having breakfasted with Trevor and his charming wife, I was taken in the A70 a few miles out of Narrabri on the Maules Creek Road to the 800 acre grain farm, where Trevor carried out his share farming.

Despite my (then) tender years, I can somewhat egotistically state that I was an experienced and proficient tractor operator, having been working tractors of numerous makes and sizes since my schoolboy years in Scotland and as a casual tractor driver on various farms throughout NSW. But for some reason I had never come face to face with a Bulldog.

Baffled by a Bulldog

Accordingly, when Trevor introduced me to his KL Bulldog I was frankly perplexed. When I was urged to mount the thing and start the engine, I experienced a feeling of total inadequacy. During the journey to the farm in the Austin, I had boasted of my tractor talents, and here I now was faced with a tractor about which I simply hadn't a clue!

Where was the starter button, or alternatively the crank handle? Why on earth did it feature an exhaust pipe resembling a 44 gallon drum? What was that lump sticking out from the front? What was the idea of the unconventional side mounted radiator? I was about to have all these questions answered.

I watched wide eyed with amazement as Trevor clambered up into the driver's cockpit, reached down and pressed a leaver enabling him to extract not only the steering wheel, but also the steering shaft, which was obviously heavy. He then managed to lug the apparatus from the tractor and carry it to the offside, where he inserted the shaft into a fitting in the centre of a giant flywheel.

By now it had dawned upon my little grey cells that the

The blow lamp under the hot bulb.

Bulldog was powered by a massive two stroke valveless single cylinder horizontal semi-diesel engine, with the cylinder head pointing north. Hence the flywheel located mid ships along the side.

Trevor next proceeded to open a cupboard located on the side of the bonnet from which he extracted a gargantuan blowlamp. This he placed on a bare patch of ground, undid a bung and casually slopped petrol into the tank and also into a tray located below the actual nozzle. I was then instructed to stand clear, while Trevor produced a box of Red Heads, struck a match and tossed it at the blowlamp. WHOOSH, a conflagration!

At this stage I was starting to question Trevor's sanity.

As the flames started to settle, with asbestos gloved hands Trevor grasped the blowlamp and with its inbuilt primer pump, pressured the petrol in the tank until eventually a hissing blue flame emerged from the nozzle. The somewhat alarming apparatus was then attached to a bracket located just in front of the cylinder head under what I was to learn was a hot bulb, which would eventually turn 'cherry red' I was assured.

This was an essential component of the starting procedure as the hot bulb served to preheat the combustion chamber. I just shook my head in bewilderment.

But we were not finished. Trevor grasped a tool similar to an

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Winding the engine lubricating pump – 200 turns!

old fashioned brace and bit. But where the bit would have been there was a tip like a screwdriver. He then knelt down beside the nearside of the KL and engaged the tool in a slot, which he indicated was part of the engine lubricating pump. It was necessary to wind the brace two hundred rotations. By so doing the internals of the big single cylinder engine would be awash with oil. I could certainly appreciate the benefits of that.

It occurred to me at this stage that the International W6 I had been driving the previous month, only required the touch of a button to fire up the engine!

But Trevor had not yet finished the task of preparing the tractor ready for starting. There were numerous grease nipples waiting to have yucky grease pumped into them, some of which were located in hidden recesses under the tractor. Then, the grease gun having run out of grease, required refilling. Possibly the very worst job on the farm – in my estimation at any rate. This was before the era of grease cartridges.

Trevor inspected the hot bulb which, thanks to the sterling effort of the roaring blowlamp, was now the necessary cherry red giving me the impression it would soon start to melt! (Why cherry red and not er, tomato red)?

Following his announcement that "We are now ready", he walked round to the offside of the tractor, gave the fuel priming pump lever a couple of pumps, (crude oil fuel), before grasping the protruding aforementioned steering wheel. With feet well planted for stability, Trevor swung the wheel back and forward with a pendulum motion. It was obviously hard work. Suddenly (and I mean suddenly) there was a BANG followed by a series of grumbling detonations, as the big engine burst into life.

All good? No! The engine cycle was running backwards! (Gee, what next)? Trevor cut off the fuel at the priming pump, until the engine slowed to a halt. Fortunately he had not removed the belching blowlamp from its bracket. So the hot bulb was still hot. Grasp the steering wheel again and restart the pendulum action. BANG. This time the engine behaved itself and ran in a forward rotation. The blowlamp was removed.

My six decades of association with Bulldogs had commenced.

In conclusion

For the record, a few months following my experiences with Trevor Ward I was invited to join the staff of Lanz Australia Pty Ltd as their sales representative for the state of NSW. This was

The same KL Bulldog following its restoration.

indeed a challenging appointment as I had just turned 21 years of age. But I enjoyed immensely taking off at the beginning of each month in my company car with a boot full of Lanz Bulldog pamphlets, calling on country dealers, assisting them with demonstrations plus often helping them with the closing of sales.

I especially looked forward to organising field days and attending country shows, before then returning to the Lanz HQ in Sydney towards the end of the month and being enthusiastically greeted by the friendly German staff. Great days!

In later years I have purchased numerous Bulldog tractors (now historic classics) and together with my wife Margery, have lovingly restored them to brand new condition. We have visited the Mannheim factory, now under the control of my once arch rival, John Deere, and shared Bulldog experiences with some of their older staff members.

There is no doubt these tractors were idiosyncratic, but they certainly reeked of character and their reliability is now legendary among tractor collectors around the world.

Yes, the Bulldogs were weird, but clever! ■

IAN'S MYSTERY TRACTOR QUIZ

Question: Can you identify the mystery tractor?

Clue: It is not a Caterpillar D10.

Degree of difficulty: Dead easy to a REAL tractorman.

Answer: See page 56.

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Soil searching for better productivity

UNDERSTANDING what lies beneath the soil surface and using that knowledge for productivity gains is at the heart of a massive precision agriculture program currently being implemented on Hassad Australia's properties across Australia.

The 18-month project involves an in-depth study of more than 40,000 hectares of cropping and grazing land across New South Wales, Victoria and Western Australia.

Senior agronomist for Hassad Australia based in Dubbo, Scott Ceeney, said the work would give them a better understanding of the capability of their assets, leading to better decision making, as well as assisting in more accurately targeting productivity gains.

"On some of our farms the program has been very successful, very quickly, and on others we'll need to dig a bit deeper," he said. As an investment, we're confident it will pay for itself over time with increases in long-term productivity."

The corporate farm is working with Precision Cropping Technologies (PCT) to map changes in soil profile conditions using electromagnetic (EM) and gamma radiometric surveys.

Better understanding of the soil asset

Hassad Australia accumulated its properties relatively quickly between 2010 and 2014 and not a lot was known about the soils before the mapping work began.

"One of the objectives was simply to understand our assets better," Scott explained.

"All our properties are large and diverse and in some cases, we've aggregated a number of properties side by side with vastly different management histories."

Collecting the data involved PCT staff driving up and back across the properties on 36 metre widths, continuously taking readings with the electromagnetic and gamma radiometric sensors.

The recordings from the survey were used to create surface maps of each of the four depths of sensitivity from the DualEM and four bands from the gamma radiometrics.

The maps indicate changes in the soil profile conditions which can be driven by both physical and chemical soil characteristics, including changes in texture, depth of soil and subsoil constraints like excessive sodicity and chloride.

Michael Wells from Precision Cropping Technologies said PCT's agCloud soil sensor maps were an excellent guide to soil variability.

"When we're working with customers like Hassad Australia, we're helping them learn more about their farms and the nature of variability, and how it affects production and profitability," he said.

"Precision agriculture can be viewed as an extension of good agronomy. Generally, it's used to lift productivity through correcting limiting factors in poorly performing areas and more

Scott Ceeney, Senior Agronomist for Hassad Australia, is using soil testing as part of a massive precision agriculture project on a range of properties across Australia.

Precision Cropping Technologies have been mapping changes in soil profile conditions for Hassad Australia, using electromagnetic (EM) and gamma radiometric surveys.

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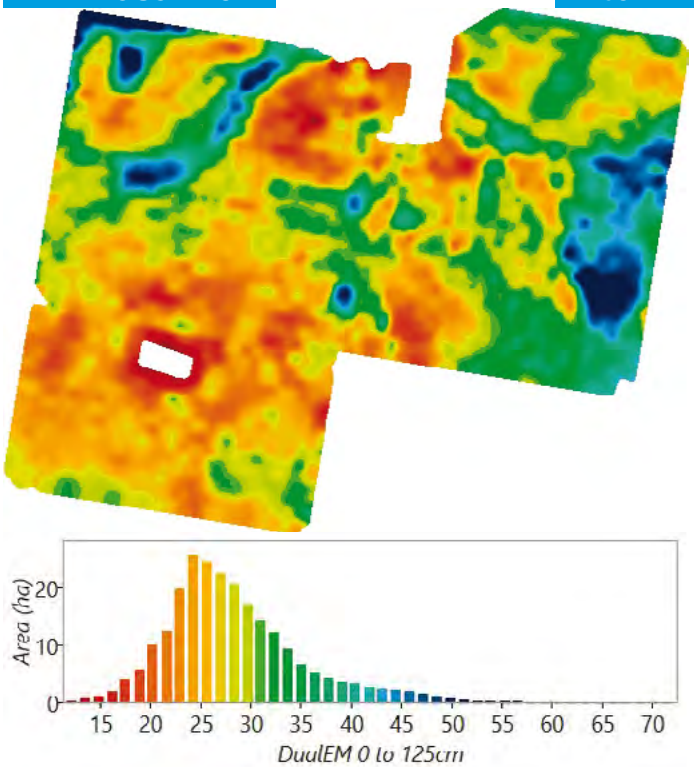
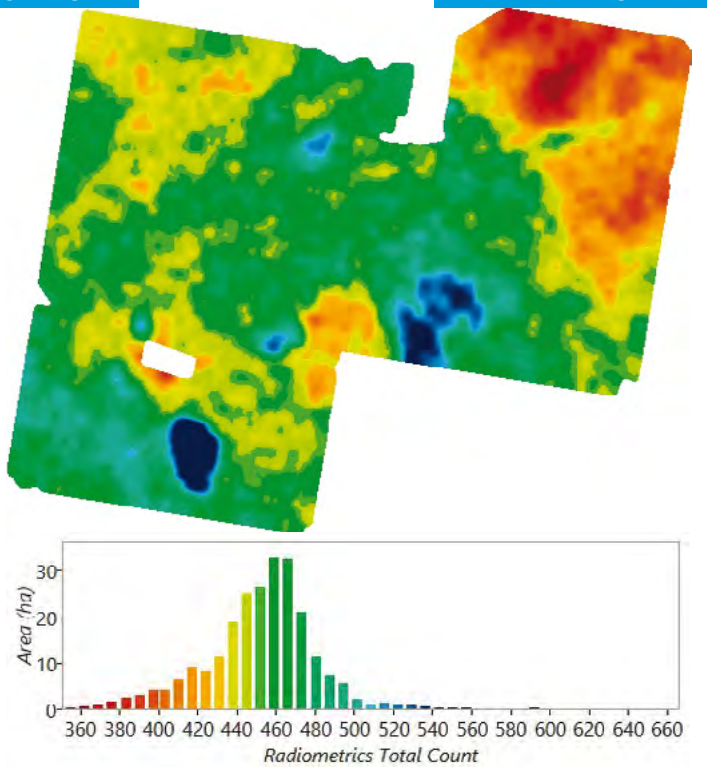


Soil maps like these are then used to define where soils change and guide soil testing. This shows the electromagnetic survey data for a paddock, to a depth of 125 cm.



This map shows the gamma radiometric data for the same paddock.

significantly, to identify the best growing environments for opportunities to drive profit even higher."

Michael said the process often started with farmers picking up variability on a yield map and looking to find the cause. By analysing changes in the soil environment, they can see and statistically analyse if there is a correlation with the yield map.

"Changes in soil conditions are often the major driver behind the variation in production within a field or farm," he said.

Soil sampling and testing is the next step

"Soil sampling and soil testing is the next step, to provide an objective measurement of these changes.

"While the soil sensor maps define where soil is changing, it is essential to determine the real nature of this variability and its agronomic importance. Our software has an enormous amount of power to build information and new knowledge, but to find out what is going on, you still need to get in the field, have a look and soil test."

With Hassad Australia, for example, the initial scanning and mapping process provided a very clear guide for testing.

PCT provided Hassad Australia with a detailed prescription for soil sampling, down to individual GPS points for each soil core.

"It showed how many samples we needed to take for each test to be representative and exactly where they should be taken from," Scott said.

Around 2500 soil tests have already been taken as part of the program.

Hassad and PCT are using Incitec Pivot Fertilisers' Nutrient Advantage laboratory for soil testing on the east coast, a NATA accredited laboratory specialising in soil, water and plant tissue testing for farmers.

"We're 75 per cent through the soil testing component of the process now and it's been fantastic," he said.

The results are prompting a range of changes.

"We are looking closely at some areas of continuous cropping country that may be better utilised under perennial pasture, because of high chloride results," Scott said.

"In other cases, we've changed crop rotations because the soil profile and crop type weren't compatible. We're also targeting a larger range of fertiliser products and seeing some promising responses."

Nutrient Advantage was selected for the analysis work for its consistency and reliability.

"There's a progressive learning that comes from sampling and testing and we use Nutrient Advantage for regular soil testing on all our east coast properties," Scott said.

Hassad Australia's farm managers also conduct a range of nutrient response trials each year and these are supported by soil testing and satellite imagery.

Base for future success

The commitment Hassad Australia is making to soil surveys and soil testing is an excellent base for ongoing success, according to Jim Laycock, Agronomist with Incitec Pivot Fertilisers, based in Cowra.

"Soil testing is still the best way for farmers and their agronomists to understand their most valuable asset – their soils – as well as better manage fertiliser inputs for productivity and profitability," he said.

"Growers can use soil testing in a range of ways, for short term goals in next season's crop, longer term management of the farm or for precision agriculture applications."

For Scott, the project is just one part of a wider precision agriculture program across the company, focused on maximising productivity gains, targeting cost reductions and better managing risk. "In my opinion, we have chosen the ideal industry leading partners in PCT and Nutrient Advantage for the completion of this program and we look forward to its continuing success," he said. ■

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When nearby plants touch leaves, neighbours' roots grow away from crowded areas.

Plants can use underground communication to check on stress

CORN seedlings that grow close together give off underground signals that impact the growth of nearby plants, reports a study published May 2, 2018 in the open-access journal *PLOS ONE* by Velemir Ninkovic from the Swedish University of Agricultural Sciences, Sweden.

Plants have developed complex, chemical systems of communication to compensate for their immobile lifestyle. Many of their messages take the form of chemicals secreted by roots into the soil, which are detected through the roots of nearby plants. These secretions tell plants whether their neighbours are relatives or strangers and help them direct their growth accordingly.

Looking for growth changes in nearby plants

To better understand how aboveground interactions affect this underground communication system, the authors of the present study stressed corn seedlings and then looked for growth changes in nearby siblings.

They brushed the corn leaves to simulate the touch of a nearby plant leaf and then collected the chemicals secreted by the roots in the seedling's growth solution.

New plants transferred into that growth solution responded by directing their resources into growing more leaves and fewer roots than control plants.

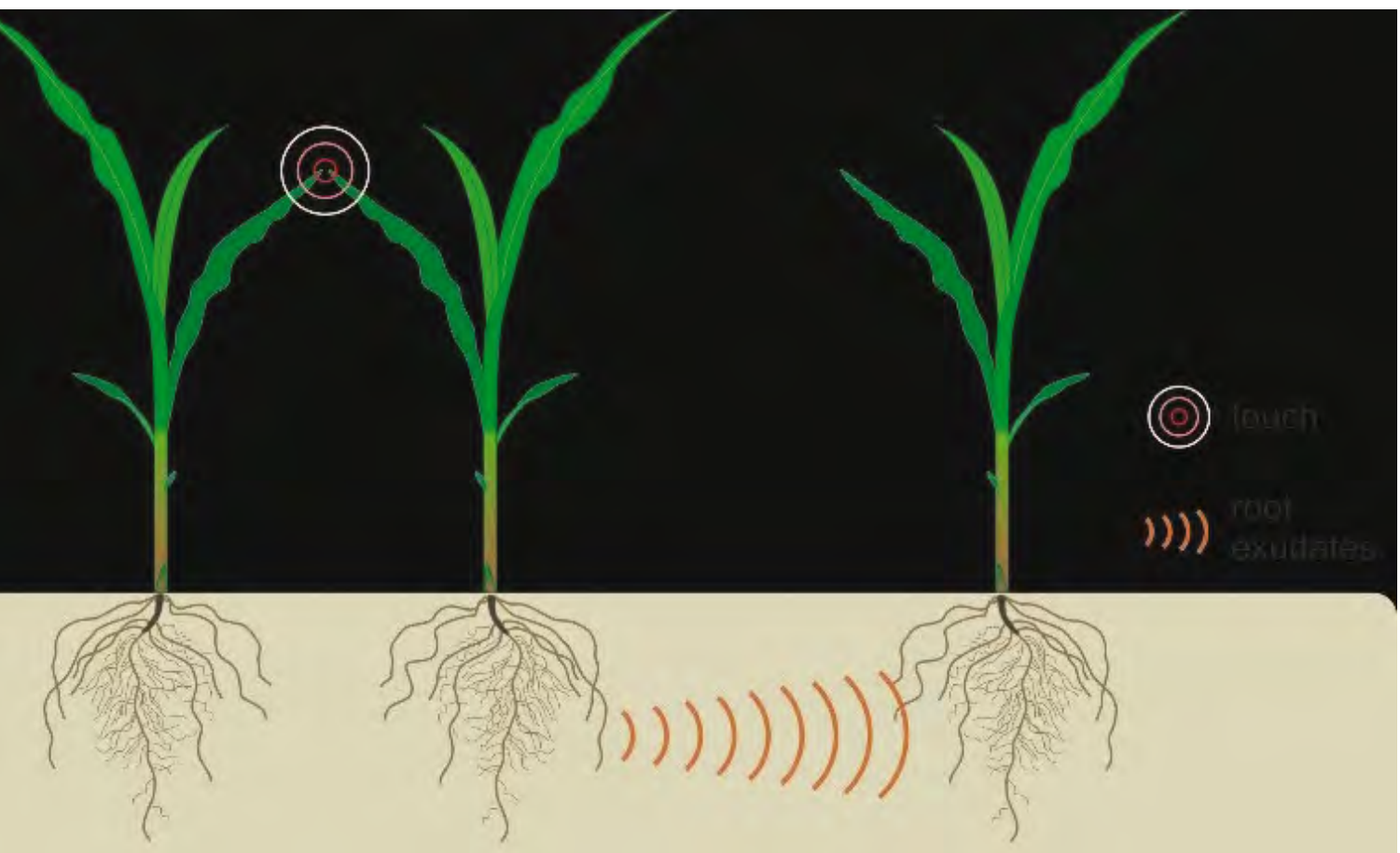
The authors also tested newly germinated corn seedlings to see if they could detect differences in growth solutions from plants that had been touched and those that had not been disturbed.

The seedling's primary root grew preferentially toward solutions from untouched plants, suggesting that it could differentiate between the two solutions.

The researchers demonstrated that even brief disturbances aboveground can lead to changes in underground communication that cause nearby plants to change their growth strategies.

They note that researchers should take into account the extent to which they touch plants during an experiment, such as occurs while taking measurements, as the effects on touched plants and their neighbours have the potential to impact experimental results.

Lead author Velemir Ninkovic says: "Our study demonstrated that changes induced by above ground mechanical contact between plants can affect below ground interactions, acting as cues in prediction of the future competitors." ■



Graphical illustration of above ground interactions between neighbouring plants by light touch and their effect on below-ground communication. (PHOTO: Elhakeem *et al* 2018)

NORTHERN FOCUS
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Competitive crops can assist weed control

DEPRIVING weeds of sunlight and space has been proven to work as a complementary tactic to take the pressure off herbicides as the 'heavy lifters' of in-crop weed control.

As part of a five-year Grains Research and Development Corporation (GRDC) investment project, crop competition factors are being assessed in a bid to boost weed control options for grain growers and agronomists in the northern region.


Dr Michael Widderick.

The Queensland Department of Agriculture and Fisheries (DAF) evaluated the effect of crop row spacing and density on the presence and growth of common sowthistle in faba beans and chickpea, and on early emerging awnless barnyard grass in wheat.

DAF program leader, Dr Michael Widderick said by using crop competition alongside knockdown and in-crop residual herbicides, growers could delay herbicide resistance and limit future weed populations by reducing seed set.

Both awnless barnyard grass and common sowthistle have glyphosate resistant populations and common sowthistle resistance to chlorsulfuron in Queensland is also present.

"Awnless barnyard grass is increasingly emerging earlier and affecting winter crops when residual chemistries are no longer persistent in the soil and when in-crop herbicides are either unavailable or can no longer be applied," Michael said.

"Results across faba beans, chickpea and wheat showed that growing these crops at a narrow row spacing and increased crop density reduced weed biomass and seed production, and we generally saw a yield benefit at narrow row spacing and consistently at high crop density.

"In widely spaced crop rows, weeds have a better chance to flourish due to plenty of available space for capturing light and other resources," Michael said.

Researchers found that

- Growing a competitive crop can significantly reduce weed numbers, biomass and seed production in-crop while providing increases in grain yield.
- Growing faba beans and chickpea at a narrow row spacing of 25 cm and a high plant density of 70 and 80 plants per m^2 respectively significantly reduced common sowthistle biomass and seed production while increasing crop yield. While the crop density was well above industry practice, these results show the potential benefits this can have on competition against weeds.
- Growing wheat at a narrow row spacing of 25 cm and a high density of 120 plants per m^2 significantly reduced awnless barnyard grass density, biomass and seed production while increasing crop yield.

These trials were carried out at The Hermitage Research Station in southeast Queensland but Michael said the impact of row spacing and density on weed control and crop yield will differ with the growing environment.

To take into account factors such as soil type, climate and weed density, multi-site crop competition trials are also being conducted in Wagga Wagga (NSW DPI) and Narrabri (University of Sydney).

Future multi-site trials will examine other agronomic factors that can influence the competitiveness of the crops, including variety choice, fertiliser placement and precision planting. ■

Chickpeas can compete

By the Australian Herbicide Resistance Initiative (AHRI)

LET'S face it, chickpeas couldn't fight their way out of a wet paper bag! They're not known for their competitive ability and generally, any weeds surviving in a chickpea crop are destined to set truckloads of seed.

Sowthistle, like all weeds, likes to take advantage of poor competition. It has evolved resistance to a number of herbicides, including glyphosate, and is a rather social beast spreading its seeds far and wide. There are few herbicide options for sowthistle control in chickpea crops, making the perfect recipe for a good ol' sowthistle blowout.

Despite all of this, the latest research by Michael Widderick, Adam McKiernan and Greg Harvey from QDAF with GRDC investment is finding that chickpeas can win the competition against sowthistle if they stack their deck. Growing a chickpea crop at narrow row spacing and high crop density in northern cropping regions can greatly reduce sowthistle seed production without reducing chickpea yield.

Once again, narrow row spacing and high crop density produce perfect research data showing that crop competition is a big deal.

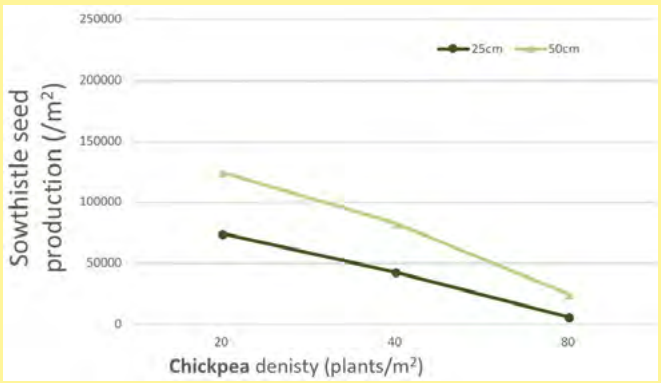
In the north-eastern cropping region of Australia, farmers are faced with a difficult weed management scenario in their chickpea crops. Chickpeas are known to be poor competitors and there are limited herbicide options for the control of common sowthistle (*Sonchus oleraceus*). Further to this, there's now also an increased number of sowthistle populations with confirmed glyphosate resistance. Whilst glyphosate won't be an option in crop, sowthistle is an all-year-round weed, so effective control in crop will dictate what population you're faced with in your subsequent fallow.

Research conducted near Warwick, Queensland has compared chickpea grown at row spacings of 25 vs 50 cm at crop densities of 20, 40 and 80 plants per m^2. Sowthistle seed was sown in each plot at a density of 70 seeds per m^2 creating a consistent sowthistle density across the trial and ranging from 12 to 30 plants per m^2.

Sowthistle seed production was the main measure of success. The chickpea (cultivar PBA Hatrick) was planted June 8, 2017 using a Kinze disc planter with fertiliser Granulock Z at 40 kg per hectare applied at planting. The field trial was irrigated and fungicide and insecticide applied as needed. No herbicide was applied in the trial to assess the full extent of crop competition on weed control, but non-target weeds were manually removed.

Kerry McKenzie of QDAF, Queensland (left) and Mike Balzer, private consultant (right).

FIGURE 1: Effect of chickpea row spacing (cm) and density (plants per m^2) on sowthistle seed production (per m^2)



Lines show the trend in data.

Seeding rate x row spacing

Figure 1 shows exactly what we have previously seen for other weeds and other crops. Weeds hate crop competition such as narrow row spacing with high plant density. Overwhelmingly, sowthistle seed production was reduced at a narrow chickpea row spacing and high crop density (see Figure 1).

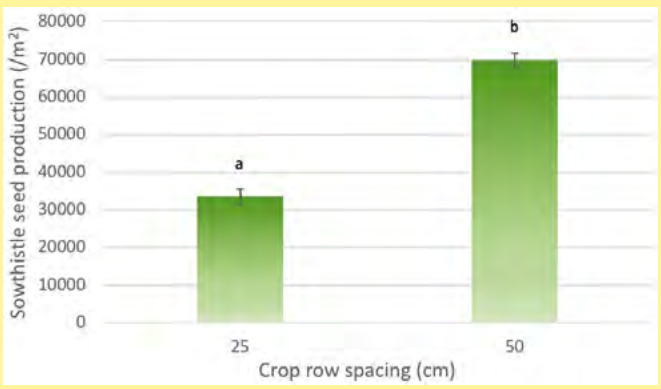
Row spacing

Changing the chickpea row spacing from 50 to 25 cm more than halved sowthistle seed set (see Figure 2).

Plant density

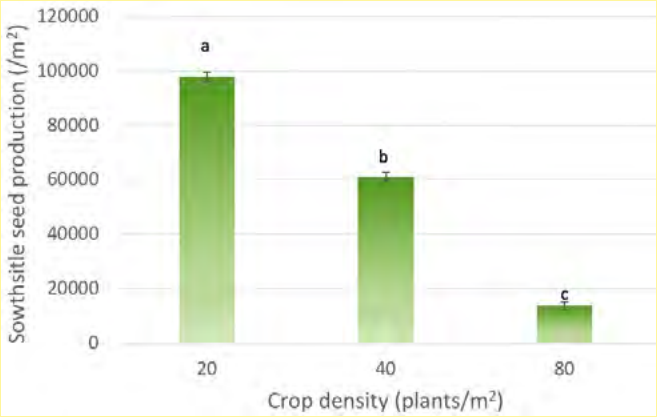
Crop competition data is beautiful, isn't it! High chickpea density smashed the sowthistle seed set (see Figure 3).

FIGURE 2: Impact of row spacing on sowthistle seed production



Significantly higher seed production at 50 cm row spacing. Bars with a different letter are significantly different at P=5%. LSD as shown in graph = 3900.

FIGURE 3: Impact of crop density on sowthistle seed production



Significantly higher seed production at 20 plants per m^2. Bars with a different letter are significantly different at P=5%. LSD as shown in graph = 3272.

FIGURE 4: Effect of chickpea row spacing (cm), crop density (plants per m^2) and the presence or absence of sowthistle, on crop yield (t/ha)

The graph shows the trend in data.

Yield

In this trial, in a weed-free situation, chickpea yield was not affected by row spacing or seeding rate. But other research has demonstrated increased chickpea yields at high crop density and narrow row spacing (see Figure 4).

Research conducted by QDAF and led by Kerry McKenzie has shown consistently that narrow row spacing in many crops including chickpeas has either maintained or increased yield.

When sowthistle was present, there was an overall trend for an increased yield at higher crop density.

To sum up

Who would have thought that the humble chickpea would have the gumption to compete with weeds? It just goes to show that all crops have the ability to compete if the crop architecture is right.

Further research from this group is evaluating the competitiveness of other crops including faba bean, sorghum and mungbean against the troublesome weeds sowthistle, barnyard grass and feathertop Rhodes grass.

We'll have to wait for the results, but you would borrow money to bet on the fact that narrow row spacing and high crop density will win the battle with weeds yet again. ■

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Irrigated wheat study yields valuable tips for growers

NORTHERN growers looking to irrigate wheat have been advised that the most profitable irrigation strategy depends on how much extra water is available to the crop as stored soil water, and how much rainfall the crop receives.

The finding is one of several conclusions from the GRDC investment into 'Better Irrigated Wheat Agronomy', a project led by CSIRO in response to the widespread failure of large areas of fully irrigated wheat in the northern region in 2008.

The five year research project assessed a range of factors to determine their impact on irrigated wheat in vertosol soils in Queensland and northern New South Wales, including the risk of lodging, applying nitrogen (N) for improved protein and yields, the use of plant growth regulators (PGRs) and the selection of lodging resistant wheat varieties.

CSIRO Project Team Leader Allan Peake said that the most important decision for irrigated wheat growers was whether the crop needed to be fully irrigated, particularly when they have several paddocks available for irrigated wheat – but not enough water to fully irrigate them all.

He said deficit irrigation – a strategy where a larger area of crop is grown and less irrigation water is applied per hectare – is comparatively less likely to cause lodging. And this strategy can be more profitable in regions or years where in-crop rainfall is more than 150 mm, and when significant amounts of stored water are available in the soil profile before sowing.

In drier conditions, they found that applying more irrigation to a smaller area was likely to be the better option.

But Allan warned that both deficit and fully irrigated paddocks can be susceptible to lodging, and growers should use a range of agronomic tools to reduce lodging risk including variety choice, irrigation strategy, N application strategy, plant population and PGRs.

The two most lodging resistant varieties available and tested as part of this research for Queensland and northern NSW are LRPB Cobra and Dart, but these can still lodge under extreme conditions.

Other key findings

- Varieties respond differently to in-crop N application. Suntop, Wallup, Kennedy and LRPB Cobra often had higher yields when N was applied in-crop but Mitch and LRPB Lancer did not. In-crop N application was found to increase grain protein by 0.4 per cent for most varieties and locations.
- The response to PGRs was influenced by N and irrigation strategy. When lodging was severe, PGRs gave the biggest yield response (0.6 tonnes per hectare) on well irrigated

CSIRO Project Team Leader Allan Peake said that the most important decision for irrigated wheat growers was whether the crop needed to be fully irrigated.

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paddocks with more than 120 kg per hectare of N available at sowing. Even when there was little or no lodging, PGRs improved yield by 0.32 tonnes per hectare on average in paddocks with more than 120 kg per hectare of N at sowing. But PGRs had a negative effect on yield for some varieties in an experiment that was only partially irrigated and experienced lower yields in the region of 5.5 tonnes per hectare.

- Growers may achieve improved yield by using row spacings as narrow as 19 cm compared to 28 or 38 cm, but the results were not consistent across varieties and locations. Achieving a yield benefit from narrow row spacing was more likely when lodging was avoided.

Full or deficit irrigation?

A study published by CSIRO in 2016 investigated whether full irrigation or deficit irrigation was more profitable for northern region growers.

Using the APSIM crop model, a range of whole-farm irrigation scenarios were investigated, with access to the same amount of irrigation water – 1300 megalitres (ML) – that was assumed to be in storage at sowing, and 1000 hectares of land were available to be irrigated.

The water was used to fully irrigate a smaller area, or partially irrigate increasingly larger areas.

A long-term climate data set was used to see if a particular strategy worked for different seasons (that is wet, dry or average), for three locations: Emerald, Goondiwindi and Gunnedah. A wheat price of $250 per tonne at the farm gate was assumed and two different water cost scenarios compared, where low cost water was $40 per ML and expensive water was $120 per ML.

The simulations were also conducted for two different amounts of stored soil water at sowing, either zero or 100 mm. The average growing season rainfall was 100 mm at Emerald, 174 mm at Goondiwindi and 212 mm at Gunnedah.

The study used the concept of 'risk efficiency' – the balance between risk and potential profit – to determine the best strategy, rather than using a long-term average gross margin.

- Generally, it showed that in a dry, warm environment (Emerald), the most risk-efficient strategy was to apply more irrigation water to a smaller area of land.
- At Gunnedah – a cooler environment with higher and more reliable winter rainfall – the most risk-efficient strategy was to deficit irrigate, spreading water over a wider area.

When water became more expensive, risk-efficiency was improved by applying more water to a smaller crop area.

Allan explained it could seem counter-intuitive to apply more irrigations per hectare to a smaller crop area to produce better profits when the price of water is more expensive.

"Full irrigation is more likely to be the most risk-efficient option when rainfall and stored soil water are limited and the cost of water is high, because larger areas of partially irrigated wheat have greater amounts of 'wasted' water through evaporation," he said.

"Smaller areas of fully irrigated wheat are also more likely to conserve water in the soil which is then available for the next crop, and we valued this remaining stored water at the same price as irrigation water in the study. But at the end of the day the price of water was less important than the amount of in-crop rainfall and stored water at sowing, when it comes to deciding on the best irrigation strategy."

Allan said it was important for irrigated wheat growers and agronomists to read the full project results booklet, and to test new techniques and varieties on a small scale first.

"Unfortunately there are no risk-free options in farming, so it is important for growers and agronomists to familiarise themselves with all of the issues before they grow an irrigated wheat crop."

'Better Irrigated Wheat Agronomy: lessons from eight years of on-farm research and experiments in Queensland and northern New South Wales'can be downloaded from the GRDC website at *https://grdc.com.au/resources-and-publications/all-publications/publications/2018/better-irrigated-wheat-agronomy* ■

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Barley grass evolves into an even greater cereal pest

A POPULATION of the widespread winter annual grass weed – northern barley grass (*Hordeum glaucum*) – has been confirmed resistant to glyphosate in Australia.

Chris Preston, Associate Professor of weed management at the University of Adelaide and chair of the Australian Glyphosate Sustainability Working Group (AGSWG), says the resistance has been confirmed in a northern barley grass population which is located along fences and around buildings on the Yorke Peninsula, South Australia.

"Northern barley grass is showing us it will adapt to herbicide control if we continue to use simple weed management strategies," said Chris, whose work is supported by the Grains Research and Development Corporation (GRDC).

"Barley grass across Australia has been adapting to changing farming practices, and we can now add glyphosate resistance to that list of adaptations."

Australian populations of northern barley grass are already resistant to the herbicide groups A, B and L.

Northern barley grass is an important plant in winter-dominant rainfall zones, being a major component of many annual pastures. It can provide early green feed for livestock, but produces damaging sharp seeds that penetrate the eyes and bodies of sheep in the spring.

It is a major competitor of cereal crops and acts as a host for cereal diseases, such as barley leaf scald and the root disease take-all.

Susceptible northern barley grass (left) and the glyphosate-resistant population (right). (PHOTO: Chris Preston)

Adapted to continuous cropping

Chris says that, having adapted to continuous cropping, populations of northern barley grass have increased dormancy, enabling it to germinate post-sowing and thus avoid pre-sowing control treatments. A lack of selective herbicides in cereals compounds the problems posed by barley grass.

"The actual level of glyphosate resistance is quite low, with resistant plants requiring eight times the rate of glyphosate for control when compared with a susceptible plant," he said.

"But as has been demonstrated with other species, active management is required to control even low levels of resistance."

Several weed species have now evolved resistance to glyphosate in crop margins or fence line areas, including annual ryegrass (Lolium rigidum), brome grass (*Bromus diandrus* and *B. rigidus*) and now barley grass. This demonstrates the importance of effective weed management in these areas and not relying just on glyphosate.

"Annual ryegrass has shown that glyphosate resistance often develops along fences and moves into the cropping paddock, and we don't want to repeat this mistake with barley grass," Chris said.

Management strategies to reduce the risk of glyphosate resistant barley grass on fence lines include:

- Double knocking with another herbicide mode of action or cultivation, using robust rates of glyphosate;
- Improving spray coverage; and,
- Using tank mixes at robust rates of both herbicides that are effective on the target species.

Fortunately, most of the strategies developed for glyphosate-resistant annual ryegrass on fence lines will work for barley grass.

The AGSWG is supported by GRDC and key R&D-based crop protection companies with an interest in the sustainability of glyphosate. The group's website has a range of information about glyphosate resistance, including a register of glyphosate-resistant weed populations and guides and links for management of glyphosate resistance in different crops and management situations. Go to: *www.glyphosateresistance.org.au* for more information.

For information on herbicide sustainability, visit the WeedSmart information hub at *www.weedsmart.org.au*

Has herbicide resistance in ryegrass in WA plateaued?

"The nice part about being a pessimist is that you are constantly being either proven right or pleasantly surprised." George Will, American journalist, author and Pulitzer Prize-winner.

WE are not pessimists at AHRI, but let's face it, we rarely have good news when it comes to reporting on the level of resistance progression on Australian farms. We are normally proven right that herbicide resistance levels are continually increasing.

The latest results from the AHRI random ryegrass resistance survey of WA led by Dr Mechelle Owen isn't necessarily good news, but it's about as good as we could have hoped. We know that herbicide resistance levels almost never decrease through time, so the very best that we can hope for is that resistance levels plateau, which is what Mechelle found for a number of herbicides.

Every five years, Mechelle, one of our dedicated AHRI researchers, undertakes the massive task of visiting 500 fields in Western Australia just before harvest to sample seeds of surviving weeds for resistance testing with GRDC support.

Figure 1 below shows that the percentage of paddocks with resistant ryegrass has only risen slightly since the last survey in 2010. The graph is reporting on all levels of resistance, with more than one per cent survival to a herbicide. It's no surprise that resistance to the sulfonylurea (SU), and Fop (Diclofop) herbicides didn't worsen from 2010 to 2015, as these herbicides were already totally shot. What was surprising, was that resistance to clethodim (Dim) and trifluralin and glyphosate was roughly the same in 2015 as it was in 2010. This was a very pleasant surprise.

Every five years Mechelle Owen takes surviving weed samples from 500 fields.

Why is it so?

Perhaps it's simply that resistance evolves slower to these herbicides than herbicides such as Fops and SUs. Or, could it be that we're on the right track with managing resistant weeds using a diverse range of tools to delay resistance evolution? It's likely to be a bit of both. .

Mechelle has tested a number of weed species in this survey. Table 1 details the herbicides and rates used in the testing. We'll focus on ryegrass for now (Table 2) and report on the other species in future editions of AHRI insight.

Sulfonylurea 2015

Of the 500 fields visited in 2015, four of these fields contained ryegrass that was susceptible to SU herbicides. There were high levels of resistance to this herbicide in 2010 and that's still the case. This may seem obvious, but it does confirm what we have always said, that resistance is permanent.

In the absence of a fitness penalty, once a population of weeds becomes resistant, it stays that way.

Fop 2015

As for SU herbicides, there were very high levels of resistance in 2010 and this is still the case.

Clethodim (eg. Select) 2015

This was the big surprise package in the 2015 survey. We saw a large shift in resistance from the 2003 survey to the 2010 survey, and naturally we expected to see a large increase in 2015, but resistance levels in 2015 were similar to 2010. Having said that, we now have 44 per cent of paddocks in a random survey with resistance to a high rate of clethodim, which is of great concern.

FIGURE 1: Random resistance surveys showing percentage of WA populations with resistance

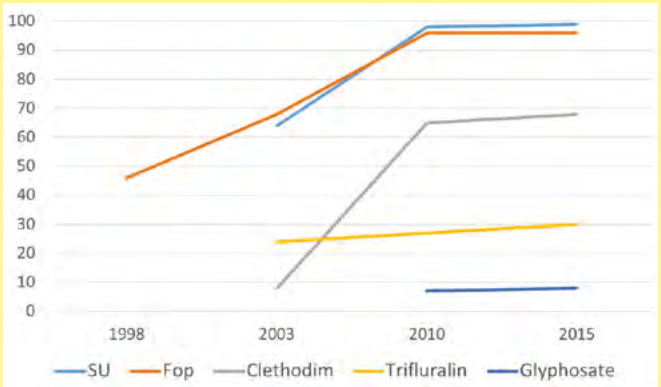


TABLE 1: Herbicides and rates used for resistance testing of the 2015 random survey

	Product	Active ingredient	Label rate	Active rate (gai/ha)
SU	Oust	Sulfometuron	20 g/ha	15
Fop	Hoegrass	Diclofop-methyl	1.0 L/ha	500
Dim	Select	Clethodim	250 & 500 mL/ha	60 & 120
Trifluralin	Treflan	Trifluralin	2.0 L/ha	960
Glyphosate	Roundup Ready	Glyphosate	1.5 L/ha	810
Atrazine	Atrazine 900 g/L	Atrazine	1 L/ha	900
Paraquat	Gramoxone	Paraquat	1.2 L/ha	300

TABLE 2: Percent of fields in Western Australia with herbicide resistant ryegrass from random surveys collected between 1998 and 2015 for a range of herbicides

	SU	Fop	Clethodim 250 mL/ha	Clethodim 500 mL/ha	Trifluralin	Glyphosate	Atrazine
1998		46					
2003	64	68	8		24		
2010	98	96	65	42	27	7	2
2015	99	96	68	44	30	8	2

Keep in mind that the tested plants in this survey were grown outside in winter conditions in 2016, so the concerns of getting better than expected results with clethodim when plants are tested in warm, summer conditions are not relevant here.

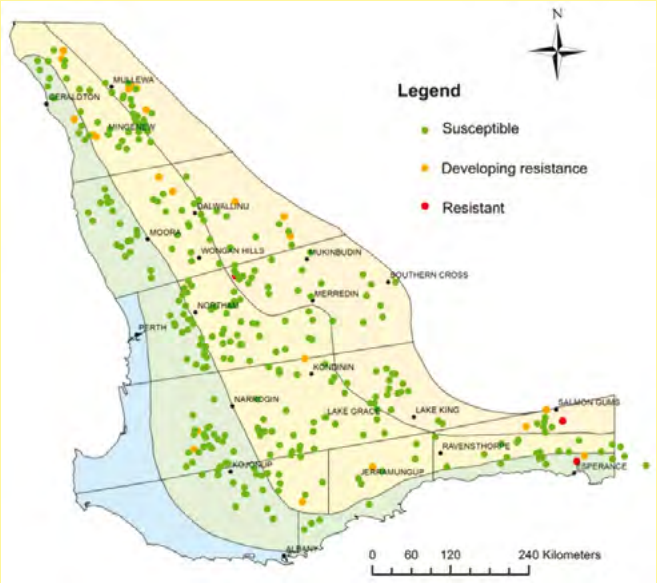
Trifluralin 2015

We know that trifluralin resistance levels are high in parts of South Australia and Victoria, and we expected WA to go in the same direction. But once again we were pleasantly surprised the trifluralin resistance levels have not moved much since the 2010 survey. But 30 per cent of paddocks with trifluralin resistance is a significant challenge that we are now facing in WA.

Glyphosate 2015

Glyphosate resistance has remained about the same from 2010 (7 per cent) to 2015 (8 per cent). We must be cautious with this result as we know that when resistance to a herbicide is relatively rare it can be hard to pick up with a random survey.

FIGURE 2: Glyphosate resistance levels in WA



Other more targeted surveys have found much higher levels of glyphosate resistance. It's encouraging nonetheless.

In the 2010 survey all of the glyphosate resistant populations were found on the south coast. This wasn't the case in the 2015 survey as some resistant populations were found further north.

Paraquat 2015

This survey found no populations with any resistance to paraquat. It's hard to find very rare resistance genes with a random survey but it's a good result nonetheless.

Sakura

No resistance to Sakura (pyroxasulfone) was found in this survey.

Boxer Gold

Perhaps one of the surprises of this survey was that 11 per cent of the populations were found to be developing resistance (1–19 per cent survival) to Boxer Gold (prosulfocarb + s-metolachlor).

It's possible that this cross-resistance is due to P450 enzymes that have built up during years of selection with other herbicides resulting in low level resistance to Boxer Gold. Mechelle tested many of these populations three times to confirm this result.

Developing resistance vs. resistance

The results that we have reported here are one per cent survival or greater. We generally refer to developing resistance as being one per cent to 20 per cent survival, and resistant as greater than 20 per cent survival to a herbicide.

As we dig deeper into the data we may find a shift in the level of resistance within the populations, so while we have reported here that resistance levels have stayed about the same from 2010 to 2015, there may be a little more to the story in time to come.

To sum up

It's encouraging to see that ryegrass resistance hasn't moved as far as we may have expected in the past five years. Perhaps the diverse weed management practices that are being used by growers are paying off. This result should encourage us to try and keep these levels this way when the next survey comes around in 2020. Resistance may not regress, but holding it level is the next best thing. ■

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Positive returns for soil renovation

A SIX-YEAR project assessing the effects of spading, mouldboard ploughing and claying on sandplain soils in Western Australia's South Coast region has shown these systems can increase returns by more than $500 per hectare – but some of the benefits diminish over time.

South Coast sandplain soils often have multiple limitations. The research, undertaken with GRDC investment, aimed to compare long-term effects of 'mix and invert' strategic tillage systems versus traditional mechanical methods to reduce common soil constraints, such as compaction, water repellence and acidity.

Lead researcher David Hall, of the Department of Primary Industries and Regional Development (DPIRD), said trials at the Esperance Downs Research Station from 2012 to 2017 found mouldboard ploughing was the most profitable treatment during this period.

He told the 2018 GRDC Grains Research Update, Perth, that mouldboard ploughing, claying and spading increased crop yields by 3.3–4.0 tonnes per hectare during the length of the trial, compared with the control plots.

"Spading with clay and mouldboard ploughing were the most effective systems for reducing the degree of water repellence in the soil, compared with the control and all other seeding and wetting agent treatments," he said.

David said high soil strength (known as penetration resistance) was markedly reduced to a depth of 35 cm by spading and mouldboard ploughing treatments, but the differences between these treatments and the control diminished with time.

A trial plot at the Esperance Downs Research Station showing a control treatment on the left and a spaded treatment on the right. (PHOTO: David Hall, DPIRD)

He said at the start of the trials in 2012–13, the soil strength in the control area was up to 2000 kPa higher than the spading treatment at a depth of 28 cm. But by 2016, the corresponding difference was 1000 kPa.

The trials have also raised issues about whether the effect of mouldboard ploughing and spading on soil strength is enough to achieve a crop's optimal yield potential, according to David.

Restricted root growth

"The high subsoil strengths and periodic waterlogging at the Esperance trial site almost certainly restricted root growth, with few roots observed and measured below 40 cm depth in any treatment," he said.

"This suggests that root depth is important, even in higher rainfall environments, and that the spaded and mouldboard ploughed treatments may not be de-compacting the soil to the depths required to achieve yield potential.

"Deep ripping prior to spading or mouldboard ploughing is practiced commercially and it would seem to be justified here, based on the high soil strength below 45 cm depth."

David said soil water extraction profiles showed almost no water extraction below 70 cm, regardless of treatment.

He said an Agricultural Production Systems sIMulator (APSIM) analysis of the trial site showed that restricting roots to soil depths of 70, 60 and 50 cm reduced predicted crop yields to 83, 75 and 67 per cent, respectively, of the water-limited yield potential in any given season.

"Crop emergence was improved by the inversion tillage and clay treatments in some, but not all, years," he said.

"In most years, sufficient plants emerged to achieve the yield potential, regardless of which treatment was used.

"Plant numbers exceeded 115 plants per square metre for cereals and 35 plants per square metre for canola in each year, irrespective of the treatments.

"Weed populations measured in 2013 were halved by the mouldboard ploughing and spading treatments (5 weed per m^2) when compared with the control (10 weeds per m^2)."

David advised farmers in the South Coast region to also take into account ploughing risks when using tillage systems that mix and invert the soil.

"These risks include wind erosion, so consider the months with the lowest wind speeds – such as March – and it helps to maintain surface 'roughness' to prevent erosion," he said.

"It is also ideal to establish groundcover immediately." ■

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Regrowthmaster Arvesta Motsa*

Valor* & other Targa*Bolt

Flumioxazin Gesaprim*

products Hammer*

Logran* B-Power Midas* Intervix*

Sharpen* Raptor* WG

Flame* 240g/L Cheetah* Gold

Precept* Destiny* OnDuty*

Prosaro* Skope Decision*

Movento Terbyne*

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Managing lupin anthracnose

NSW Department of Primary Industries (DPI) has reminded farmers that this season is critical in the strategic management of the devastating disease, lupin anthracnose. DPI plant pathologist, Kurt Lindbeck, said surveys across NSW in 2017 found no evidence the disease has spread beyond six Riverina properties identified with the disease in 2016. This was the first detection of the disease in NSW.

"That's good news, but infected seed could remain undetected and this season every NSW lupin crop must be managed as a possible disease risk," Kurt said.

"Fungicide seed treatment is crucial in implementing an anthracnose management plan as infected seed is the primary means of pathogen survival and spread. Rhizobia should be applied to seed at sowing, to maximise survival and minimise exposure to fungicide seed dressings, which are toxic to rhizobia."

The five point lupin anthracnose management plan:

- Lupin seed should be treated with a fungicide treatment containing thiram;
- 2018 lupin crops should be isolated from last year's lupin stubble;
- Control volunteer lupins on your property;
- Control machinery and people movement into and out of lupin crops; and,
- Apply foliar fungicide containing mancozeb, chlorothalonil or azoxystrobin at six to eight weeks post emergence with a follow-up treatment at pre-canopy closure.

WA research found follow-up foliar fungicide applications in combination with seed applied fungicides were highly effective in reducing the transmission of anthracnose between seasons. ■

Anthracnose symptom – shepherd's crook stem.

Global production risks all ahead

By Luke Mason – Wheat Trader – COFCO International Australia

MAY, June and July are generally the critical months for northern hemisphere cereals and row crops. But the seasonal risks facing the global grains market this year take on more importance than previous seasons due to a forecast generally tightening in worldwide corn and wheat stocks. This is on top of problems already experienced in Brazil and Argentina which have taken the total South American corn crop estimates down about 20 million tonnes (mt) on earlier predictions.

EU and Black sea wheat and barley crops enter the most critical part of the growing season in the next month. In general, it will be challenging to repeat the excellent conditions experienced last year in Russia (ultimately leading to record wheat production), and consequently, crop forecasts are generally around 8–12 mt lower than last year. The remarkable thing is that Russia has disposed of their current season wheat very efficiently with exports likely to almost reach a record 40 mt by the end of July, up by a significant amount from the previous year (which was a record high at the time) of 27 mt.

For next season, Russia is still forecast to have their second biggest crop and second biggest exports on record in the 2018–19 season, but we are still around six weeks away (the end of June) from being able to determine the final crop size.

There have been generally dry conditions over April and early May but recent forecasts for rainfall are starting to look better – this is on top of recent rains in some areas.

Ultimately, the Black Sea region – and Russia in particular – seem very likely to have significant drawdowns on wheat stocks in 2018–19.

North America also dry

Over to North America and the US Hard red winter wheat crop is in worse condition relative to the five-year average. The problems in HRW are documented, but despite a drawdown in 2018–19 ending stocks, US supplies remain adequate in the absence of needing to fill the export demand for crop problems elsewhere.

Spring wheat planting in the US is behind schedule while further north in Canada, spring wheat conditions are dry in Manitoba and parts of Saskatchewan with warmer and drier conditions expected over the coming months.

USDA's May 10 World Agricultural Supply and Demand report (the first such report for the 2018–19 season) confirmed the tightening grain carry-out stocks in 2018–19, not only for the US wheat and corn but the global balance sheets as well.

While there is still a long growing season ahead, it's hard to see any 2018–19 upside production surprises that could pull carry-outs back up to or above 2017–18 levels.

If these forecasts come to fruition over the next few months, it will justify to buyers and farmers why prices have recently moved higher.

And if production comes in below these levels, we quickly get stocks down to levels where consumption/feeding patterns will undergo significant change.

For Australian growers, all the above should see a supportive tone to values at least for the next three to four months. There is scope for higher values if we were to see crop problems develop in any of the major corn or wheat producing countries.

Weather forecasts and actual outcomes will face increased scrutiny and will have more impact on prices and volatility than they have in almost five years.

Supplied May 15, 2018

CHINA AND GRAIN STOCKS

The recurring theme for the past four years has been big crop after big crop keeping global stocks burdensome. Rallies have been few and far between, but maybe 2018 is shaping up as a game changer.

While global stocks are heavy, no doubt, there is a disproportionate amount of these stocks for both wheat and corn sitting in China. And once they're in China, we tend never to see them again. It is highly unlikely that China exports them to the world – even if there was a price shock.

What hasn't had airplay over the past four years is that there has also been a corresponding boom in global demand and if we see a few production issues build, then this enormous demand base will start to get nervous.

Corn at US$4.00 per bushel and $5 wheat will then look pretty cheap if production hiccups develop into full-blown issues.

Matthew Pattison – COFCO International Australia

Are Australian grain supply chains getting cheaper?

AT A GLANCE...

- The cost of moving grain from farm to port is around one-third of the total cost of grain production. Growers have limited control over what is usually their single largest cost.
- There is opportunity to help growers determine whether supply chains are best meeting their needs.
- In 2014, AEGIC released comprehensive analysis of the cost of Australia's grain export supply chains and has updated that analysis.

THE costs associated with most Australian export grain supply chains have remained stable or slightly reduced over the past several years, according to the Australian Export Grains Innovation Center (AEGIC) analysis.

Ahead of the release of a new report AEGIC analysts presented preliminary findings at GRDC Research Updates around the country.

AEGIC Chief Economist Professor Ross Kingwell said supply chains across Australia had changed significantly over the past five years. Changes have included a reduction in the number of receival sites, further evolution of grain transport, changes to port regulation, rainfall zones shifting closer to ports, and other infrastructure changes.

"On average, costs have reduced slightly in recent years, but costs vary depending on magnitude of the grain harvest," Ross said.

"After accounting for these variations, supply chain costs are consistently about 30–35 per cent of the total cost of grain production.

"Total Australian grain supply chain costs are higher than most of our competitors, except for Canada, yet some components of our supply chains compare favourably. For example, charges for grain transport from up country receival to port have decreased 12–13 per cent in real terms. But in this example, the reduction is offset somewhat by the fact that, on average, most growers now need to travel further to deliver grain to fewer receival sites."

Ross said further improvements to Australia's supply chains were essential to help preserve the international competitiveness of Australian grain exports.

"Further improvements in grain yields, greater investment in infrastructure, improvements in supply chain operations, regulatory reform and a greater intensity of cropping in higher rainfall regions will all help lower the average cost of Australia's export grain supply chains," he said.

"These improvements are essential, especially considering that Australia's grain export competitors, such as Russia, Ukraine and Argentina, are continuing to drive down their costs through major investments in on-farm and post-farm improvements."

Preliminary findings summary

Australia's export grain supply chains have changed significantly over the past five years. Overall costliness has remained generally stable or decreased slightly in real terms in some areas. For example, the rebates offered by CBH to its grower members over the past two years has lowered the effective cost of supply chain services to those members.

The supply chain costs of Russia, Ukraine and Argentina are likely to decrease further, placing more pressure on Australia.

Unlike some of Australia's competitors, cost transparency is often lacking in key parts of the supply chain. More formal monitoring of supply chain costs may be required.

There are emerging opportunities to further lower the costliness of Australia's grain supply chains. ■

Wheat quality rises to the top in Asia

By Larisa Cato[1], Chris Carter[1] and Roslyn Jettner[2], AEGIC

AT A GLANCE...

- Australian wheat is well regarded in both Vietnam and Thailand markets for its quality and suitability for instant and fresh noodles and this may be strengthened by an improved understanding of noodle texture attributes.
- At present, Australian wheat producers have less opportunity to meet demand from Thailand for the quality of wheat preferred for production of sandwich bread.
- Gluten quality and quantity is very important for both Vietnamese instant noodles and bread products.

SOUTH East Asia (SEA) is the largest regional market, by volume, for Australian wheat. Vietnam is the second largest importer of Australian wheat averaging 1.5 million tonnes per year over the past five years (2012–16) and Thailand is Australia's tenth largest market. Over the past five years, Australian wheat imported by both Vietnam and Thailand has totalled more than 10.5 mt valued at A$3.2 billion.

SEA markets are critical to supporting demand and prices for Australian wheat and therefore, extremely important for Australian producers. In these markets, Australia is experiencing an increase in competition from cheaper wheat supplied from the Ukraine, Russia and Argentina as well as strong competition from North American wheat based on functional performance for baking applications.

To maximise Australia's export opportunities we need to develop an improved understanding of the preferred wheat quality attributes and their target levels.

What our research set out to do

To identify the quality attributes and their preferred levels most valued by flour millers in Vietnam and Thailand for noodle and bread products that can enhance the demand and value of Australian wheat.

Wheat technical and purchasing staff from 18 flour milling companies in Vietnam and Thailand participated in the research project aimed at identifying their preferences and target levels of wheat quality characteristics for instant or fresh noodles and breads. The products studied in Vietnam included instant noodles and Vietnamese bread/baguettes (Bahn Mi) and products studies in Thailand included fresh noodles (Bamee) and sandwich bread.

The project applied choice analysis methodology to collect objective information on the wheat preferences of grain end-users.

The comparative importance of 31 wheat quality, functional and technical service attributes for the selection of wheat for SEA style noodle and bread products was ranked from most to least importance by mill technicians and wheat purchasers from each company.

What we found

For wheat purchasers, perhaps unsurprisingly, price and wheat protein content, overwhelmingly dominate their selection of wheat to buy for fresh noodles and breads in Thailand. Of more interest, and somewhat enlightening, were the findings in Vietnam that gluten quality and quantity were ranked as more important than price.

Vietnam – instant noodles

Noodle texture, gluten and protein properties and dough extensibility were the quality attributes of most importance when selecting wheat for instant noodles in Vietnam. Noodle colour brightness and colour stability were ranked by other SEA markets as very important when selecting wheat for fresh noodles.

But noodle colour brightness and colour stability and the associated attributes of flour and grain colour were not rated as high as for instant noodles in the Vietnam study. This may be partly due to the preservation of colour stability by the immediate frying at high temperatures of the instant noodles.

It is important to note that the flour millers understood and value the advantages that white wheat compared with red wheat provide for instant noodles. Australian wheat has the advantage over alternate origin wheats for both noodle brightness and colour stability and is the preferred wheat for both fresh and instant noodles.

It is imperative that these advantages be maintained within Australia's wheat classification process to ensure the value of Australian wheat for noodles can be differentiated and remain attractive to markets.

Texture attributes and targets for the instant noodles in Vietnam need to be better understood by the Australian industry, along with standardised objective assessment methods, to ensure Australian wheat can consistently meet the textural firmness required for instant noodles.

For wheat purchasers, similar attributes of noodle texture and characteristics contributing to texture were rated as most important, although with a different ranking with gluten properties being rated as the most important attributes. Price was also rated as important.

Vietnam – Bahn Mi

The largest segment, by volume, of the bakery industry in Vietnam is Banh Mi, a Vietnamese-style baguette that is lighter and airier compared with a typical French-style baguette.

The quality of Banh Mi is influenced by both wheat and flour quality and functional properties. Bread volume and dough rheological characteristics that contribute to bread volume were most valued by mill technicians when selecting wheat for Banh Mi. Similarly, purchasers ranked gluten strength as the most important attribute when selecting wheat for Banh Mi despite this attribute not specified on sales contracts.

Thailand – fresh noodles

Thailand Bamee noodles belong to the family of yellow alkaline noodles (YAN), typically made with flour, water and alkaline salts. Bamee noodles are often sold in the market place three to five days after manufacturing. Colour, colour stability and mouthfeel (texture) are important quality traits. The ideal texture or eating quality is a firm bite, elastic and smooth mouthfeel. For mill technicians, wheat protein content and noodle texture attributes were ranked as the most important attributes along with noodle colour stability and brightness.

For wheat purchasers, price was overwhelmingly the most important factor for the selection of wheat for Bamee. And similar to the technicians, wheat protein, noodle colour and texture attributes all achieved a high importance index score.

Thailand – sandwich bread

Sandwich bread is the highest valued segment for wheat flour use in Thailand with white loaf bread dominating this segment. Wheat protein content and water absorption were ranked by mill technicians as the most important attributes along with dough and fermentation tolerance and dough stability time. Achieving the ideal loaf volume is the single most important objective.

In Thailand, protein is considered more important than wet gluten content as was the result from our previous Philippines and Malaysian study. Loaf volume was not included in this study but is described by project co-operators as the primary driver of bread quality.

Consistent with wheat purchasers from all South-East Asian countries studied, price and wheat protein content were overwhelmingly the most important attributes when selecting wheat for sandwich bread. Dough strength (Rmax), milling yield, water absorption, wet gluten content, and uniformity of shipment were recognised as important quality characteristics.

To sum up

This study documents and reinforces the advantages of Australian wheat for Vietnamese instant noodles and Thai fresh Bamee noodles.

Our research results can inform Australia's wheat variety classification process of quality requirements for wheat classes. User target levels can guide the selection of benchmark varieties for current wheat classes and quality parameters for amended or new classes. Moreover, identifying target levels and value attributed by users can improve the efficiency and effectiveness of investment decisions regarding wheat quality research by highlighting attributes of most value.

The Australian wheat industry can ultimately benefit from this study through better targeted wheat breeding and more effective varietal classification. Wheat producers can then aim to produce a high-quality product with the characteristics that meet the requirements of end-users.

The AEGIC project team thanks the following for their valuable contributions: GRDC provided significant investment for project operations; AEGIC provided financial investment and expert personnel to conduct the in-market research, support and project review; and most importantly all of the milling companies in Vietnam and Thailand that agreed to actively participate in the research.

1. Australian Export Grains Innovation Centre.
2. Formerly with AEGIC now Department of Primary Industries and Regional Development. ■

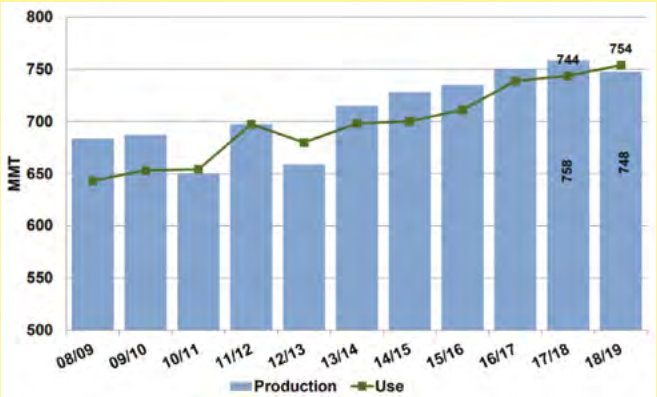
Chinese wheat stocks mask tight stocks-to-use ratio

By Stephanie Bryant-Erdmann, US Wheat Associates Market Analyst

IN the May USDA *World Agricultural Supply and Demand Estimates* (WASDE) the 2018–19 global wheat supply is forecast to hit a record 1018 million tonnes (mt) despite the expectation that global wheat production will fall for the first time in five years to 748 mt.

At the same time that global wheat production is expected to decrease, global wheat consumption is expected to reach a new record of 754 mt, 5 per cent above the five-year average.

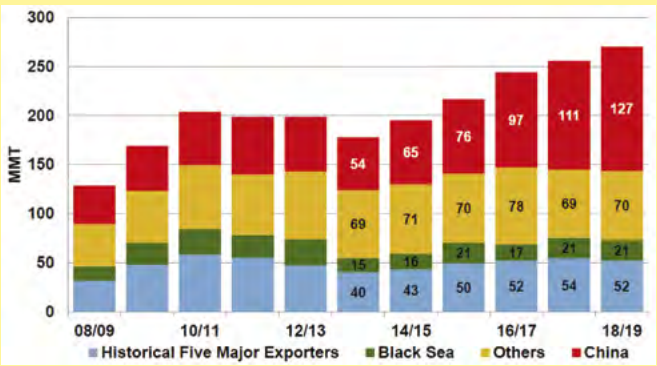
World production and use



The reason global wheat supplies continue to grow is because of an anticipated 6 per cent year over year increase in beginning stocks – 47 per cent of which are in China.

This large percentage of global wheat stocks residing in China's wheat stocks are masking an otherwise declining global wheat supply.

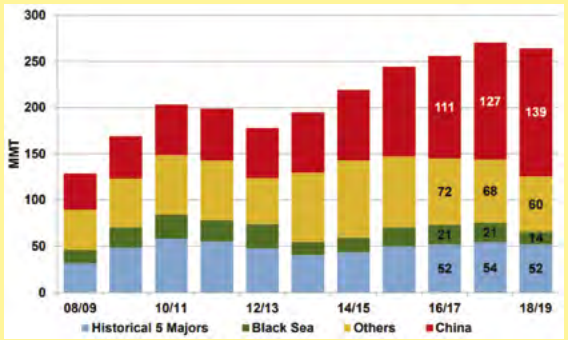
World beginning stocks



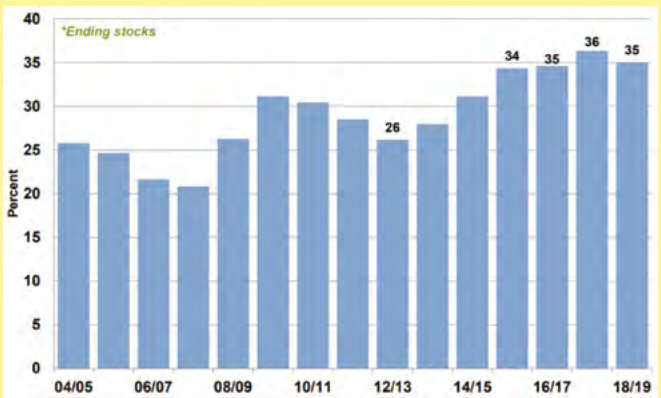
By the end of 2018–19, USDA expects Chinese ending stocks to total 139 mt, 52 per cent of global wheat ending stocks.

Because China's endings stocks are masking the declining global wheat supply, the traditional stocks-to-use ratio is 35 per cent.

World ending stocks

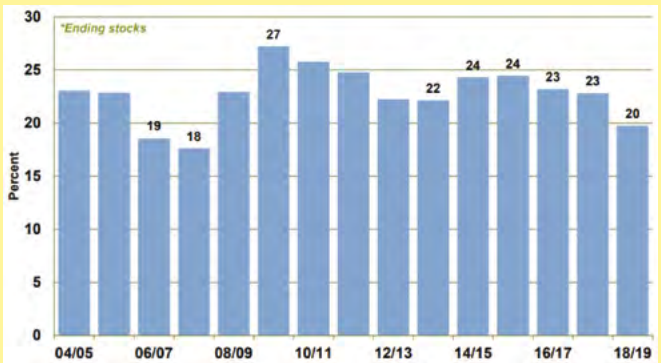


Global stocks*-to-use ratio



But when Chinese stocks and use are removed from the ratio, the 2018–19 global stocks-to-use ratio falls sharply to 20 per cent – the tightest stocks-to-use ratio since 2007–08.

Global stocks*-to-use ratio without China



We should continue to monitor conditions around the world and recognise that global wheat supplies are much tighter than traditional global supply and demand estimates show.

US Wheat Associates *Wheat Letter* – May 17, 2018. ■

Managing costs key to staying competitive with Black Sea wheat

MANAGING production and logistics costs will be essential for Australian wheat producers to remain competitive in the South-East Asian market, in the face of the growing threat from Black Sea Region imports, a visiting global grains export has warned Australian growers.

Rabobank global grains strategist Stefan Vogel said while there was some good news in the outlook for wheat prices – with a reduction in the amount of global stocks across the world (outside of China) and dry weather across the US winter wheat areas elevating wheat prices across US exchanges.

But with the Black Sea Region wheat crop expected to be in good shape – it will be upcoming Black Sea (and primarily Russian) exports into South-East Asia – Australia's primary wheat export market – that will determine price prospects for Australian growers. And in order to ensure they remain competitive with the low-cost Black Sea Region producers, grain growers will need to keep a close eye on their own cost structures, while at the same time maintaining the high quality grain for which Australia is renowned, he said.

London-based Stefan said while the wheat price was currently enjoying a resurgence – with Chicago Board of Trade (CBOT) prices climbing mor than 20 per cent since mid-January 2018 – this was primarily driven by concerns about prolonged dry conditions and the prospect of a reduced 2018 harvest in the US.

Rabobank global grains strategist Stefan Vogel.

"The short-term wheat price outlook has improved due to yield risk in the US because of the dry weather conditions, but it is the Black Sea Region (comprising Russia, Ukraine, Romania, Bulgaria and Hungary) which again has good growing conditions, which is posing the largest risk for physical wheat prices," Stefan said.

"The good news is for now prices are supported, but for how long? At the end of the day, the Russian crop will tell us where prices need to be. It might not matter how long there is dryness in the US, it will be a matter of what your export competition is doing and that will come out of the region of Russia."

Emerging powerhouse

Stefan said Black Sea Region wheat exports into South-East Asia had grown significantly from 2011 to 2017. And that growth trend was not expected to abate in the future.

"There has been a really dramatic increase in wheat production out of Russia particularly in the past two years, primarily driven by good weather. We've seen 2016 production 15 per cent above the previous record and 2017 production almost 20 per cent above that again," he said.

"And when Russia has a massive crop, it needs to try to get it on to the world market. And we see the impact clearly this season where Russian exports are moving to South-East Asia to a much larger extent."

While a more 'normal'-size crop is expected in Russia (and the other Black Sea Region countries) in 2018, Stefan said he expected "the crop size we saw in the record 2017 season in Russia will be the standard in 10 years' time, with the country regularly being able to produce the sorts of volumes of wheat we've seen in the past year".

"In 10 years' time, we will have up to an additional 25 million tonnes more Black Sea wheat coming on to world export markets, compared with the volumes seen in 2016/17 – with even larger Russian exports than this season and further yield increases in Ukraine and the Danube region, which will add additional wheat supplies to the overall Black Sea exports," he said.

"The question is – will there be enough demand in the world for the wheat that Russia and the Black Sea has to provide?"

African and South-East Asian import growth key

Growth in demand from Africa (Russia's traditional wheat market), and particularly sub-Saharan Africa, is expected to absorb much – "but not enough" – of this additional Russian production, Stefan said. And the South-East Asian market would continue to be a focus for Russian wheat exports.

"After the African demand growth over the next 10 years is satisfied, we will have probably five million tonnes of excess Russian wheat and more volumes from other export regions that still have to go somewhere else in the world, and that is likely to be South-East Asia," he said.

"The good news for Australian growers is that the demand for wheat in that region is growing, driven by population growth and diet changes, but the question is whether the demand in South-East Asia is big enough to absorb it all.

"Australia is clearly the prime supplier in South-East Asia

and our view is that the market will continue to be there for Australian wheat, but the competition will be ongoing. This will likely see Australia lose market share in percentage terms, though not in actual volume as the South-East Asian market grows."

Nevertheless, Stefan said, "keeping a close eye on costs will be extremely important in Australia to make sure you stay competitive in the game".

"Labour costs are high here, and land prices are also something to keep a close eye on when it comes to farm expansions because Russia is very competitive on the cost side with a currency that is fairly weak. That said, inland logistic costs in Russia and Ukraine are high and the supply chain in those countries needs to improve to handle future volumes.

"Still, cost control remains crucial for growers to maintain a competitive position, though not at the expense of maintaining the high quality product that your exports markets prize." ■

BLACK SEA PRICES PROVIDE SOLID FLOOR IN THE ASIAN WHEAT MARKET

■ Luke Mason – Wheat Trader – COFCO International Australia – Melbourne

In early 2018, Black Sea milling and feed wheat values have rallied around US$20 per tonne as record demand and exports continued to gnaw away at what was also considered a record crop. At the same time, ASW and APW wheat export values in both South Australia and Western Australia have managed to strengthen, but only by US$10 per tonne.

Accordingly, the freight advantage into Asian markets for Australian wheat moved about US$5 per tonne in Australia's favour as the freight rates rose. All in all, Australia's competitiveness had improved around US$15 per tonne in the first three months of 2018 throughout Asian markets.

This change in price relativities saw Australia only between US$5–10 away from competing into various feed wheat markets in the region versus Black Sea. In an environment where Australia only really needs to export 14–15 million tonnes, feed wheat demand from any markets other than Philippines – where Australia enjoys a seven per cent tax advantage – does not need to occur.

So, what we saw was some very solid support for the Australian market, due to these price relativities. Any further rallies in Black Sea values will therefore, need to be matched by Australia to ensure that there is no excess Australian wheat disappearing into the feed channels at the expense of reasonably inelastic milling demand, particularly at current pricing spreads.

Now, to the flipside….

Do we see any downside to Black Sea values? The same scenario that we have outlined above has also played out in Black Sea/EU cash relativities where we see EU wheat values much more competitive versus Black Sea than most of the season. With still a large exportable surplus in France and to a lesser degree the Baltics, this can likely place some semblance of a cap on Black Sea values if EU wheat starts to displace demand.

But in the current market there is limited evidence of this. Russian exports continue to be strong and we don't see French values calculate to Egypt. Russia also continues to bask in the sunshine of record export demand, and it is approaching the back end of the export campaign over May, June, and July.

Seemingly, it will be difficult for us to find anything but support and perhaps even stronger old crop Russian values in the next few months, as higher values become apparent here.

New crop growing conditions in Europe and Black Sea remain favourable and the rallies we have seen have been demand led (as opposed to supply fear rallies recently witnessed in US futures). It will make it even more interesting for cash values if this is to change at all in coming months…

Supplied March 13, 2018.

All hail the whole grain!

By Jan Suszkiw, Agricultural Research Service – USDA

AT A GLANCE

- Whole grains offer health benefits over refined-grain foods, like white flour.
- Whole grains retain their fibre, vitamins, minerals, and other nutrients.
- Whole grains should be eaten daily.

A HUMAN nutrition study reaffirms the health benefits of substituting refined-grain products like white bread with whole-grain foods like whole-wheat bread, oatmeal, barley, rye, and brown or wild rice.

Scientists with the Jean Mayer USDA Human Nutrition Research Center on Aging (HNRCA) – jointly run by the Agricultural Research Service (ARS) and Tufts University in Boston, Massachusetts – conducted the study to clarify the role of whole grains in helping regulate weight, blood sugar levels, and calorie (energy) use, among other benefits.

Unlike refined grains, which undergo extensive milling or other processing, whole grains are sold for consumption with their bran and other constituents intact – all rich in vitamins, minerals, fibre, carbohydrates, and phytonutrients.

First study of its type

The study, published in the February 2017 online issue of the *American Journal of Clinical Nutrition*, is the first to strictly control participants' diet, weight, and type of whole-grain products they consumed, according to the HNRCA researchers and their coauthors. Previous clinical trials, they add, didn't incorporate these important study design criteria, leaving the benefits of whole-grain diets – especially on weight management – open to question.

"Epidemiological studies have previously shown that consuming whole grains is associated with better weight management, but that kind of research can't tell what is cause and what is effect," notes Susan Roberts, a senior author and director of the centre's Energy Metabolism Laboratory. "What this study did was provide a metabolic explanation for why whole grains help weight management."

In the eight-week study, the researchers determined the weights and calorie (energy) intake needs of 81 participants – healthy, nonsmoking men and women ages 40 to 65 – and started them on a diet free of whole grains. At week two, the researchers randomly switched some participants to diets containing the daily recommended allowance of whole grains (a minimum of 85 grams for women and 110 grams for men).

Besides measuring weight and waist circumference, the researchers monitored all participants' insulin and blood sugar levels, resting metabolic rates (energy expenditures while sedentary), and adherence to the whole-grain diets using specialized tests. The participants were also asked about their dietary habits and activity levels. Analysis of stool samples helped to calculate calories excreted rather than burned or stored.

At HNRCA, Susan Roberts (left) and nutrition technician Wintlett Williams prepare and measure food for study volunteers. (PHOTO: Deb Dutcher)

HNRCA research assistant Lijun Li uses a pipet to prepare samples for identification of intestinal microbes and concentrations of cytokines. (PHOTO: Deb Dutcher)

At HNRCA, graduate student Mitra Rozati prepares samples for immune system assessment. (PHOTO: Deb Dutcher)

Among the results, participants in the whole-grain group lost approximately 100 more calories per day than refined-grain eaters – the equivalent of walking briskly for 30 minutes, notes Susan. Her team attributes the lost calories in the whole-grain group primarily to increased metabolic rate and increased faecal energy losses.

Diet's effect on immune system cells

In a tandem study, Simin Nikbin Meydani, director of HNRCA's Nutritional Immunology Lab, led a team in comparing the dietary effects of whole or refined grains on certain types of immune system cells, changes in populations of intestinal microbes, and concentrations of cytokines – proteins that can serve as markers of inflammation in the body. Inflammation is associated with cardiovascular disease, type 2 diabetes, and certain cancers.

With this study, "We wanted to see if whole-grain consumption – under conditions where food intake was controlled and weight was maintained – would impact gut microbiota and the ability of immune cells to fight against infection as well as produce inflammatory markers," says Simin.

"We found that whole grains, even in the absence of a significant difference in weight, have a modest effect on gut microbiota, which could be beneficial in terms of reducing inflammation and improving immune response to pathogens. Related to that, we observed that participants in the whole-grain group had cytokine levels similar to those of the refined-grain group but slightly higher number of immune cells involved in defence against pathogens – notably of infection-fighting memory T cells."

Specifically, the whole-grain diet gave a moderate boost to populations of beneficial Lachnospira bacteria, which make protective short-chain fatty acids and help counteract another bacterial species that contributes to inflammation. Such gut bacteria comprise a larger community of microorganisms, called the microbiota, that live on or in the human body. They are of increasing interest to scientists for the diverse and often beneficial roles they play, including helping digest food, extract nutrients, regulate metabolism, and protect against disease and infection, among others.

At HNRCA, Energy Metabolism Laboratory director Susan Roberts holds whole-grain foods used in the study. (PHOTO: Deb Dutcher)

The researchers note that their study used products made from whole-grain flour and one type of grain and that consuming intact whole grain kernels or a mixture of grains may confer even greater benefits than those they observed. In addition, the weight loss that is associated with consuming more whole grain, often observed under uncontrolled conditions, might have additional impact on gut microbiota and associated biological changes, such as those of the immune response.

The take-home message, says Susan, "is that whole grains are carbohydrates we can feel good about eating for health as well as enjoyment."

Further information
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Simin Nikbin Meydani, D.V.M., Ph.D – Laboratory Director, Senior Scientist Nutritional Immunology Laboratory; Ph: +1 (617) 556-3129; E: simin.meydani@tufts.edu

■

Baiting mice: Equipment set-up a key to success

GRAIN growers planning to bait mice at seeding and through the growing season are encouraged to pay particular attention to the set-up and performance of their equipment to ensure optimum baiting impact.

Experts supported by the Grains Research and Development Corporation (GRDC) say while a number of different approaches to spreading mouse bait are available to growers, in all instances it is critical that equipment is calibrated to deliver bait at the required label rate to enhance success.

Zinc phosphide-coated bait must be applied at one kilogram per hectare across the paddock, excluding a 50 metre buffer zone to the edge of the crop and any native vegetation.

PRACTICAL BAITING TIPS

To assist growers with their mouse baiting programs, the GRDC has made new resources available for viewing at *www.grdc.com.au/mousecontrol* and via the GRDC YouTube channel at *goo.gl/75e4Vz*.

Mouse bait can be applied via a number of mechanisms, including air commodity carts, 12-volt broadcast spreaders, conventional linkage and trailing machines and bespoke innovations. (PHOTO: Ben White)

One kg per hectare equates to around two to three bait seeds per square metre.

Distribution should be as uniform as practical but the key is ensuring swaths no larger than 12 metres are unbaited. Because mice will move around the paddock to feed, they will inevitably pick up bait if this guideline is adhered to.

Agricultural engineer Ben White says bait can be applied via a number of mechanisms, including air commodity carts, 12-volt broadcast spreaders, conventional linkage and trailing machines and bespoke innovations.

Air commodity cart: "If growers opt to spread mouse bait at the time of seeding, they can use the small seeds box or small seed meter rollers of their air commodity cart for metering the bait, and dedicated air line for distribution," Ben says. "This ensures the uniformity of seed and fertiliser across the seeding bar is not impacted.

"The small seeds box or small seed meter rollers are often used because the bait application rate of one kg per hectare is low. Dispersion of bait using this method is usually via secondary air lines on to dispersion plates at the back of the bar, which, depending on mounting height, spread the bait uniformly over a series of two to three metre bands across the width of the seeding bar.

"Alternatively, for tow-behind air cart configurations, growers have fitted custom plumbing to redirect the air flow and distribution spouts to blow the metered bait out across a working swath."

12-volt systems: Using a single spinner attached to a 12-volt

To assist growers with their mouse baiting programs, the GRDC has made new resources available. The practical tips and guidance, including videos, feature advice from agricultural engineer, Ben White. (PHOTO: Ben White)

motor, Ben says 12-volt broadcast spreaders can be mounted to a vehicle, quad-bike or tractor. Hopper capacity is between 30 and 100 litres with a single spinner powered by a 12-volt motor.

"Typically spreading mouse bait to about 24 metres, the 12-volt broadcast spreaders use a choke to adjust the flow of bait onto the spinner. While some designs use the spinner rotation to meter bait through the choke, others have a choke shut-off so the spinner can continue to rotate and a door starts or stops the flow of bait to the spinner."

Conventional spreaders: Ben says linkage and trailing spreaders can also be used to spread mouse bait. Because these spreaders usually involve two large spinner discs, bait can be spread to around 36 metres.

"The primary challenge with using these larger spreaders is achieving the very low baiting rate of one kg per hectare," he says. "Some linkage and trailing spreaders with scales and computer-controlled metering chokes have settings for small seeds which may deliver a one kg per hectare rate.

"Belt-style spreaders may require a very low door setting and slow belt speeds to achieve one kg per hectare and some models may require the metering door width to be modified. A piece of stiff rubber fixed to the metering door with slots cut in it can be used to choke down the width of metered product."

Farmer innovation

Innovative growers have also built and modified equipment for spreading mouse bait, according to Ben. "These include using conventional belt spreaders to carry a mouse bait hopper in the bin with other product. The bait hopper is fitted with a separate metering door and bait spreader plates, allowing bait to be spread concurrently and thereby saving a working pass."

Safety

Ben reminds growers and bait application operators to wear appropriate Personal Protective Equipment (PPE) when baiting with zinc phosphide.

"Wear elbow length PVC gloves and a full face respirator, ensuring the respirator has a combined dust and gas cartridge, including a 'B' category. This is particularly important when opening the drum of bait as high concentrations of phosphine gas can be released – and always open the drum in a well-ventilated area to allow gasses to disperse."

GRDC investment

Meanwhile, researchers have embarked on Australia's largest investment into mouse-related research in the grains industry. The GRDC recently announced it is injecting more than $4.1 million into mouse control research, development and extension initiatives in response to the increasing prevalence of mice in many key grain-growing regions of Australia.

The new initiative includes three key investments which will be led by CSIRO. The first investment of more than $3.2 million focuses on understanding mouse ecology, biology and management, the second on increasing surveillance, and the third on mouse feeding preferences.

To further support growers with their mouse management strategies, the GRDC GrowNotes *Better Mouse Management Tips and Tactics* fact sheet and other useful resources are available via *www.grdc.com.au/mousecontrol*.

Growers and advisers are encouraged to continue to report and map mouse presence, absence and level of activity using MouseAlert (*www.mousealert.org.au*) so others can see the scale and extent of localised mouse activity. ■

Mice in the sights of major new research aim

AUSTRALIA'S largest investment into mouse-related research in the grains industry was recently announced by the GRDC.

The GRDC is injecting more than $4.1 million into mouse control research, development and extension (RD&E) initiatives in response to the increasing prevalence of mice in many key grain-growing regions of Australia.

GRDC Managing Director Dr Steve Jefferies says the GRDC recognises the enormity of the mouse problem and the severe impact it has on our growers' businesses, their families, their communities and the broader industry.

"The issue with mice has escalated in recent years and we need to improve our understanding as to why that has happened so we can provide growers with innovative and more effective mouse control options and tactics."

Three investment areas

The new initiative includes three key investments that will be led by CSIRO. The first investment of more than $3.2 million focuses on understanding mouse ecology, biology and management, the second on increasing surveillance, and the third on mouse feeding preferences.

The first investment will provide growers and industry with a greater understanding of the behaviour of mice under no-till and stubble retention systems, and it will quantify the impact of various management tactics (such as strategic tillage, seeding systems, food and habitat reduction) on mouse numbers.

Until now, management strategies to control mice have been based on research conducted under conventional cropping systems which often incorporated tillage, burning and removal of stubbles, as well as more livestock than is typical of today's farming systems.

"Our farming systems have changed markedly since then," Steve said. "No-till, stubble retention and in many cases little or no livestock are now the norm in many areas, so we need to know whether these contemporary, conservation farming practices are now favouring the persistence of mouse populations from one season to the next due to maintenance of year-round habitat, lack of soil disturbance, or whether there are other factors at play.

"We are no longer seeing a plague situation one year, followed by a sudden crash in the population and the absence of mice for extended periods of time thereafter. These days, mice seem to be a constant and our high-yielding crops and heavy stubbles appear to be providing them with an abundance of food and protection."

Technologies such as in-burrow cameras and radio-tracking devices are expected to be used during the studies to better understand mouse behaviour.

The second key investment of more than $630,000 will expand and extend GRDC's involvement in national mouse monitoring and surveillance. The aim is to develop a more precise 'real-time' national early warning system for potential plagues and equip growers with the ability to proactively manage increases in mouse populations to minimise crop losses and reduce economic impacts.

The third key investment commits up to $275,000 to investigate mouse feeding preferences and bait efficacy.

Broad scale application of zinc phosphide wheat bait (at the prescribed rate of one kilogram per hectare) is currently the only method available for growers to control mice in their paddocks – but efficacy of this bait has become an issue.

An investment in this area will explore conditions which lead to the apparent reduction in attractiveness of zinc phosphide baits and subsequent lower efficacy. The two key questions relate to the role of background food availability on baiting efficacy, and whether there are more suitable bait substrates.

"It appears mice have an aversion to the wheat-based bait in some situations," Steve said. "This could be due to the availability of more appealing alternative food sources, such as barley and pulses, so the GRDC and its research partners will be endeavouring to determine if this is in fact the case.

"Researchers will also be investigating whether mice stockpile non-baited grain and other food sources in order to survive, and if so the research will aim to determine the optimum time to bait to overcome this mouse survival technique."

CSIRO researchers Nikki Van de Weyer and Steve Henry record mouse population data during a recent monitoring exercise through south-eastern Australia.

Continued support for other options

Dr Leigh Nelson, GRDC Manager Pests, said the GRDC was committed to exploring all options in an effort to provide growers with better mouse control solutions. In addition to the new investments, Leigh said the GRDC continued to support a wide range of other ongoing mouse-related RD&E.

The research investment announcement was delivered to growers, agronomists and industry stakeholders who participated in a recent mouse control webinar which was initiated by the GRDC in response to concerns about high mouse numbers ahead of sowing this year's winter crops in a number of regions.

The webinar featured a panel of experts and grain growers providing practical tips on mouse control in the paddock, as well as an update on regional threat levels, guides for effective monitoring, and different grower experiences with bait application at seeding time.

To support growers with their mouse management strategies, the GRDC GrowNotes Better Mouse Management Tips and Tactics fact sheet is available at *https://grdc.com.au/tt-better-mouse-management* ■

Measuring nitrogen uptake and availability in the field

By Phillip Clancy

NITROGEN is one of the major nutrients in plant growth and development. And measurement of the amount of available nitrogen in the soil helps in predicting crop yield. But soil testing can be a costly and time consuming procedure. Measuring nitrogen uptake in the plants provides us with a layer of information that helps us understand how the plants have performed and how much nitrogen from the soil ended up in the seeds.

Protein can now be measured in real-time as grain is harvested. An on-combine NIR analyser measures the protein in the grain which is directly related to the amount of nitrogen taken from the soil. By combining the yield data with the protein data a more complete understanding of the impact of nitrogen fertilisation can be achieved across the paddock.

The following outlines how measuring protein in real time – using an on-combine NIR analyser – is related to the nitrogen availability in the soil.

When does the plant need nitrogen?

As the seed sprouts and the first shoots appear through the soil, the plant needs nitrogen to develop tillers. For wheat crops, between 330 to 400 tillers per square metre should be evident.

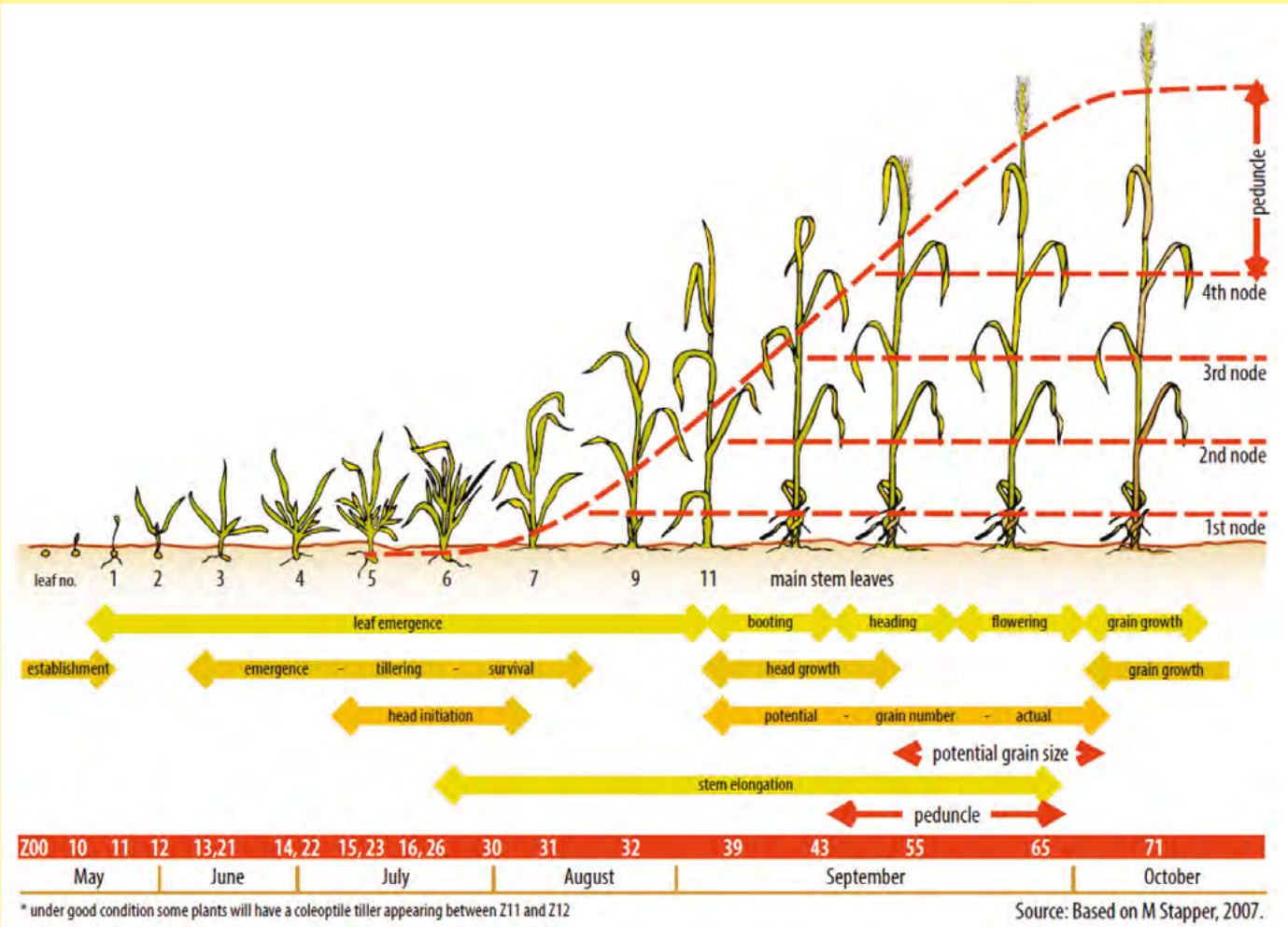
This means around 6–8 tillers per plant should be growing.

If there is not enough nitrogen present as nitrate ions in the soil at this early stage, then the crop will never achieve its water limited yield potential because there will not be enough heads produced. If there is sufficient nitrogen present then the plant should produce the 6 to 8 tillers. Figure 1 shows the growth phases for spring wheat.

You can add more nitrogen during the tillering phase, but once the plant has finished tillering, then no new tillers will grow, and some may die. The number of heads that can be produced by the plant has been determined – and therefore the yield potential.

You cannot recover the yield loss (due to insufficient tillers) by adding more nitrogen once the tillering phase has finished.

FIGURE 1: Wheat growth stages



As the plant continues to develop, the leaves capture energy from the sun and through the process of photosynthesis creates the starch and sugars required for vegetative growth – that is, biomass production.

Insufficient nitrogen in the vegetative growth phase will result in yellowing and stunted leaf growth. As such the leaves capture less light and produce less energy for growth and development.

Adequate nitrogen in the later stages of growth increases the length of time the canopy stays green – provided moisture is not limiting – thereby maximising photosynthesis. This in turn makes available more starches and sugars for use in the flowering and grain filling phases.

Adding extra nitrogen in the later stages of the growth phase will allow the plant to reach its full yield potential and produce protein as long as there is sufficient soil moisture.

During the flowering phase, the plant requires moisture and nutrients in order to produce the maximum number of grains per head. Stress caused by lack of soil moisture or nitrogen will cause the plant to reduce the number of grains per head and to maximise the available carbohydrates to fully produce the heads. The plant may also abort some heads.

The net result is a decrease in yield because there are fewer grains per head and less heads to be filled during the grain filling phase.

In the grain filling phase, any stored nitrogen will go to produce protein. If there are fewer grains per head and less heads per plant then the stored nitrogen will be distributed amongst the available heads thereby increasing the protein content.

If the plant is not under stress and there is sufficient soil moisture – but not enough nitrogen – then the yield will be high and the protein will be low.

If there is sufficient soil moisture and sufficient nitrogen then both yield and protein will be high.

As a general rule, applications of nitrogen from sowing to stem elongation increases yield, while applications after stem elongation increases protein.

Relationship between nitrogen and protein

Protein is a generic terms used to characterise a large class of bio molecules that have common chemical characteristics. Proteins are polymer chains formed from peptides which are made up of amino acids.

When humans and animals eat and digest proteins, amino acids are released which rebuilds body tissues such as skin, muscle and organs.

Edible plants such as wheat, soybeans, corn and rice make amino acids. When these amino acids are digested in the human or animal gut, peptides are formed which then go to make proteins.

The proteins found in the seeds of a plant have approximately 16 to 18 per cent nitrogen in them. As such, for every load of grain harvested from a field there is a portion of the load that is protein and nitrogen.

For example, if the protein content of the grain is 10 per cent then 100 kg of each tonne of grain is protein. And out of this 100 kg of protein there is 16 per cent nitrogen – or 16 kg.

This means that for every tonne of 10 per cent protein grain harvested off that paddock, 16 kg of nitrogen is removed from the soil.

Of course nitrogen is found in other parts of the plant tissue, but in the majority of plants nitrogen ends up in the seeds as protein.

Nitrogen and yield tells a more complete story

Yield maps measure the mass of grain that is harvested per hectare. Yet for the past 25 years yield maps have been used as a proxy for nitrogen uptake because the protein content of the seeds dictates the amount of nitrogen taken from the soil.

In reality, yield maps provide a view of how nitrogen fertiliser effects plant development and growth. But is yield the complete view?

In a perfect world there needs to be an instrument that measures the nitrogen in the soil at the time of planting as well as during the stem elongation and flowering phases.

At this time, there is no instrument that can perform such a measurement in real-time. But an on-combine NIR analyser (such as the CropScan 3000H) is designed to measure protein, oil and moisture in grain and oilseeds as the grain is harvested.

As protein is a direct measure of the nitrogen in the seeds, then this instrument can be used to generate a nitrogen removal map. Figure 2 shows a protein map, a yield map and nitrogen removal map for a wheat field in South Australia.

The yield map shows that there are large areas where the yield is low (red areas). Based on the yield map, the conclusion would be that more nitrogen is needed in these areas.

But the protein map shows that the same areas had high protein (blue areas).

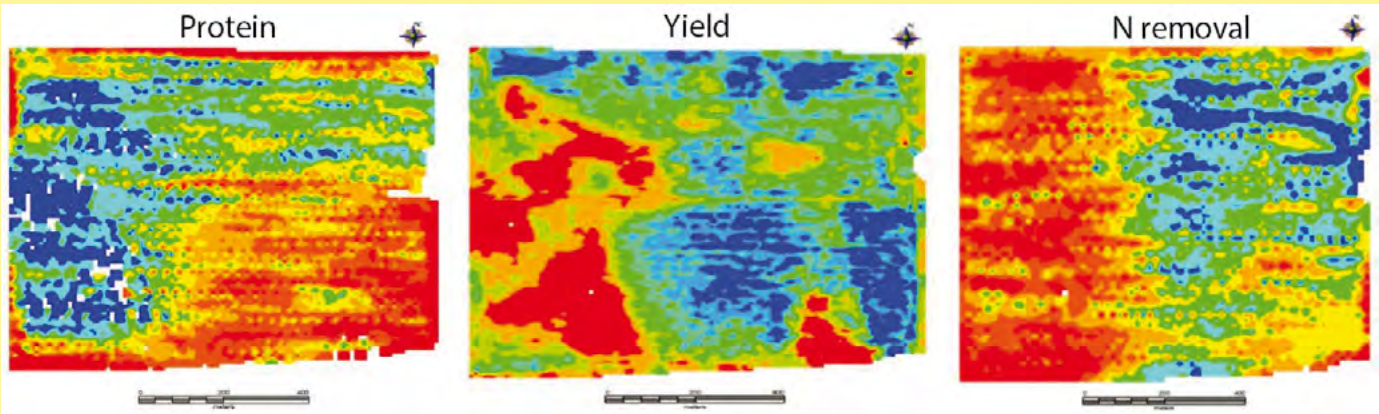
From the earlier comments above, it's apparent that there was sufficient nitrogen to fill the grain with protein.

But the yield and the protein maps appear to be contradictory. The explanation is that there was insufficient nitrogen in the soil at the time of planting and up to the end of the tillering phase.

However, the story is not finished yet.

The yield map shows a large area where the yield is high (the

FIGURE 2: Protein, yield and nitrogen removal maps from a South Australian wheat field



Grain protein, oil and moisture content can now be measured on the go.

blue areas). The protein map shows that these same areas had the lowest protein levels.

This scenario suggests that in these areas the nitrogen was available for early growth and tiller development, but there was not enough nitrogen at the grain filling phase.

As well, in these areas the protein levels are less than 10.5 per cent, making it ASW grade.

In 2015 the difference in price between ASW and APW grades was $30 per tonne.

A top-dressing of nitrogen towards the later phase of plant growth could have increased the protein levels and thereby raised the grade to APW or even H2. Top-dressing at this stage would have increased payment revenues significantly by several thousand dollars for this field.

The soil moisture profile, rainfall history, soil types and fertiliser history are important factors in understanding what has driven the plant growth in this particular paddock. A look at the nitrogen removal map shows that there are three zones:

- Red Zone 1 – left hand side;
- Blue Zone 2 – top right hand corner; and,
- Green Zone 3 – bottom right hand corner.

Reviewing the soil types in these three zones may lead to better timing of fertiliser application so that nitrogen is not leached from the root zones by rain shortly after planting.

Reviewing the fertiliser history for the field may show that top-dressing towards the end of the growth phase would have ensured fully developed plants followed by complete grain filling.

In the following season, the nitrogen removal map could be used to plan a more effective fertiliser strategy for the field so that the three zones are more consistent in terms of yield and protein.

Although a reduction in the amount of nitrogen fertiliser may be possible, it is more likely that the fertiliser could be applied more effectively and result in higher yield at the optimum protein grade.

Protein / nitrogen / yield balance

The adage "Yield is King" is exactly right. You make more money out of increasing the yield than you do by chasing higher protein wheat. But another equally relevant statement could be: "Protein is the Cream".

If you achieve the optimum yield from your paddock and get the protein grading correct, then you can add significantly to your revenues and profit.

Canadian (Alberta) agronomist Steve Larocque from Beyond Agronomy, stated in a recent newsletter that the challenge for farmers is to find the sweet spot between yield and protein in their crops. Barley and wheat, he states, should reach their optimum yield at between 11.0 and 12.0 per cent protein.

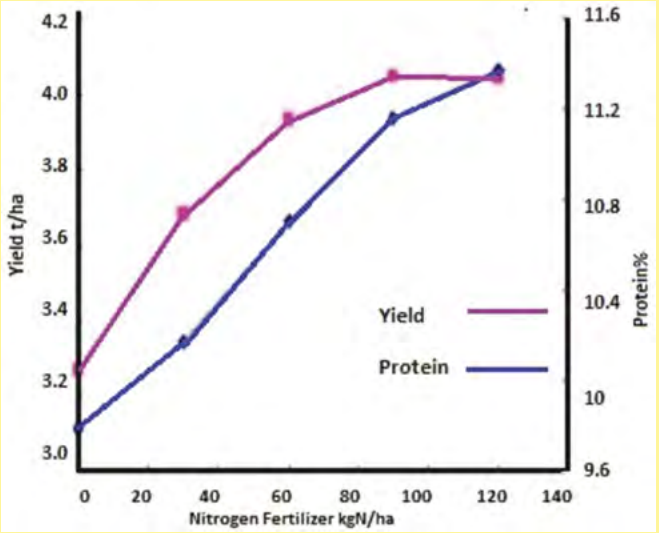
If the protein is not at this level, then the crop will not have reached its full potential yield.

Figure 3 shows the relationship between yield and protein. The optimum protein level for hard wheat is between 11 and 12 per cent. If you are not growing wheat at this protein level then you are not achieving the water limited potential yield.

APW grade requires a protein above 10.5 per cent. If you can achieving a protein level of between 11 and 12 per cent then this indicates you have achieved the optimum yield while also enjoying $30 per tonne extra compared to ASW grade.

In Australia, the bulk of wheat growers produce ASW and APW grades. By getting all loads into the APW classification, farmers can increase their revenues significantly.

FIGURE 3: The relationship between wheat yield and protein



To sum up

'Precision Agriculture' can be defined as the process of making incremental improvements in productivity and profitability by collecting and analysing data from the fields and then applying corrective actions.

It is often said that farmers have around 40 opportunities in their cropping careers to "get it right at harvest".

So every year counts and nitrogen fertiliser is one of the most critical nutrients that farmers can use to take corrective actions in their fields to effect yield and crop quality.

But you cannot take corrective actions unless you can quantify it first. An on-combine NIR analyser is the missing piece of the PA puzzle for farmers. It provides a layer of information on nitrogen uptake and availability that yield alone cannot provide.

Phillip Clancy is a Director of Next Instruments an Australian owned family company that has been developing innovative analysers for the food and agriculture markets since 1997. See *http://nextinstruments.net/index.php*

Best fertiliser bet for barley

NEW results from a barley crop in the long-running fertiliser experiment at 'Colonsay' (Darling Downs, Southeast Queensland)are highlighting the value of taking a systems approach to crop nutrition.

Bede O'Mara, subtropical systems agronomist for Incitec Pivot Fertilisers, said a review of the results showed the pros and cons of different strategies in a dry winter.

"It's the dirt, not the fert, which is making a difference at this site – it's the cumulative effect of running the cropping system in balance," he said.

He identified the nutrition combination closest to balance after more than 30 years of summer and winter crops in this experiment as 80 kg per hectare of nitrogen and 10 kg per hectare of phosphorus.

"But every year is different, and we are never going to know what the season has in store for us," he said.

"In the long run at this site, the highest yielding results from 13 winter cereal crops under all fallow lengths have been achieved when using 120 kg per hectare of nitrogen and 20 kg of phosphorus."

In 2017, coming after a mungbean crop, with low starting soil moisture and only 153 mm of growing season rainfall, this combination still provided the best yields in the Scope CL barley trial at 1.9 tonnes per hectare.

But it produced only slightly more grain than the crop grown with the least inputs, 40 kg per hectare of nitrogen and 5 kg of phosphorus, which yielded 1.8 tonnes per hectare.

Bede said the barley yields were limited by moisture, not nutrition in 2017.

"If we had received more rain – even just an average season – the crops grown with many of the higher fertiliser rates and where there was better soil fertility would have had the potential to yield much higher," Bede explained.

Historically, barley has produced up to 3.6 tonnes per hectare at the site.

Barley was grown in the long-term nutrition trial last year, and while it was limited by moisture, the results showed the benefits of maintaining adequate nutrition for good yields and the health of the cropping system longer term.

Bede O'Mara, Incitec Pivot Fertilisers.

He said gross returns net of fertiliser cost for the 120 kg per hectare of nitrogen and 20 kg per hectare of phosphorus treatment in last year's barley were solid at $379 per hectare.

Bede calculated net returns from the trial based on fertiliser prices at the time of planting in June last year ($2.71 per kg of phosphorus and $1.02 per kg of nitrogen) and $290 per tonne on-farm for F2 barley.

Growing the crop with less inputs (40 kg per hectare of nitrogen and 5 kg per hectare of phosphorus) improved gross returns net of fertiliser cost to $466 per hectare.

"You could say reducing rates last year would have worked well, but we only know that in hindsight," he said.

"To make that call at the start of the season means limiting yields and returns in average or above average seasons.

"Using 40 kg per hectare of nitrogen would also have left little to no nitrogen in the soil tank for the following season."

By comparison, he said the 80 kg per hectare of nitrogen and 120 kg of nitrogen treatments left positive nutrient balances of 40 and 80 kg per hectare of nitrogen respectively, given the lower yielding, dry season.

This 'left over' nitrogen will contribute to the 2018 crop, which is likely to be chickpeas.

Looking at nutrition for more than 30 years

Incitec Pivot Fertilisers' long-term nutrition trial was established in 1985 at 'Colonsay' on the Darling Downs in Queensland. More than 30 crops have been grown in the experiment, including five barley crops and six wheat crops, a range of summer crops, pulses and cotton.

In each crop, four nitrogen rates (0, 40, 80 and 120 kg per hectare) and four phosphorus rates (0, 5, 10 and 20 kg per hectare) are used, with Bede measuring the responses for each rate of nitrogen and phosphorus alone and in combination.

"All the better barley yields last year were achieved where nitrogen was used in combination with phosphorus (Figure 1)," he said.

"This is something we've seen consistently in this long-term experiment."

But it's more than just each crop's fertiliser application being compared.

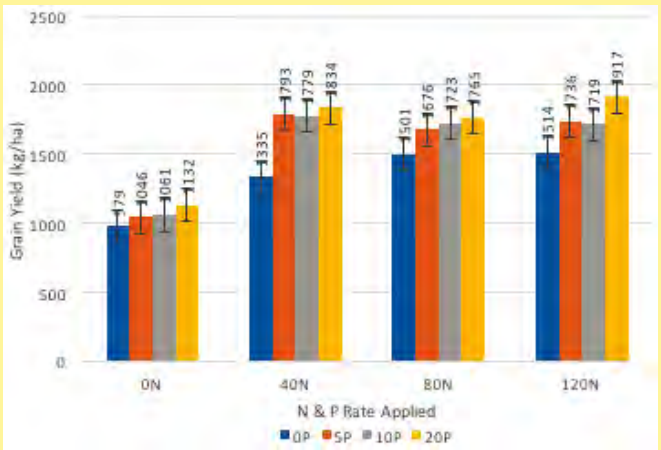
After more than 30 years with the same treatments in the same plots there are stark differences in cumulative soil fertility between plots.

For example, in deep N soil tests conducted in March this year, there was 76 kg per hectare of nitrate nitrogen in the 0–90 cm soil profile at the nil nitrogen rate and 646 kg per hectare of nitrate nitrogen where 120 kg per hectare of nitrogen had been used in every crop.

While this is a very high level of nutrient, the bulk of it is at the 30–60 cm depth where it will be available to the coming crops.

"This is not something you see on-farm because using a very high fertiliser rate like this – higher than district practice – in every crop consistently for 33 years is not something growers would do," he said.

FIGURE 1: Barley harvest yield (kg per hectare), Colonsay, 2017



Mean of all nitrogen x phosphorus treatments (error bars denote LSD p<0.05= 120.3).

Responses to different tillage operations

Bede said responses to different tillage operations were also beginning to be seen in the long-term nutrition experiment.

He singled out the deep phosphorus (deep P) treatment, where 20 kg per hectare of phosphorus was applied at 22 cm depth in December 2013 and June 2015 and compared with deep ripping and zero till treatments.

"Deep P is starting to show its value in improving fertiliser responses," he said.

"Last year, the deep P treatment showed significantly higher grain yields at all nitrogen rates compared with deep ripping and zero till treatments.

"This is consistent with findings from the Central Downs Grower Group which has seen better responses to deep P in drier seasons.

"There also appears to be some multi-nutrient interactions with the different tillage treatments which we will be concentrating on in coming crops, along with an Entec comparison to assess its suitability for protecting applied nitrogen and improving nitrogen use efficiency in broadacre cropping systems."

For growers ready to sow this year's cereals, he said it was important to ensure enough fertiliser was applied to cover the expected crop removal based on a realistic yield expectation.

Bede encouraged growers to monitor responses from a systems perspective.

"Consider putting in some high nitrogen or even nil nitrogen strips in your upcoming crops to test whether your overall nitrogen rate is adequate, as well as using grain tests to measure nutrient removal and regular soil testing," he said.■

Russian wheat aphid detected in Riverina rice

By John Fowler

AT A GLANCE…

- The discovery of Russian wheat aphid in a South Australian wheat crop in 2016, and its subsequent detection in Victoria, Tasmania and New South Wales, has added a new pest to the 'wanted' list for grain growers.
- The response of the Australian government was to declare the aphid a priority plant pest, as eradication was considered not feasible. Management of the pest is believed possible through a combination of cultural, chemical and biological controls.
- Russian wheat aphid has been detected in cereal crops in the southern irrigation areas and after its discovery in rice crops in late 2017, agronomists are advising grain growers to remain vigilant as the 2018 winter cropping season unfolds.

RUSSIAN wheat aphid has been detected in cereal crops in the southern irrigation areas and after its discovery in rice crops in late 2017, agronomists are advising grain growers to remain vigilant as the 2018 winter cropping season unfolds.

Russian wheat aphid is a major pest of winter cereals on a global scale. When it arrived in Australia two years ago, it was not expected to be seen in rice crops.

Russian wheat aphid was found on drill-sown rice seedlings in the Murrumbidgee Valley in early November of 2017. Following this report, a number of Murray Valley drill-sown crops were examined, and all were found to have the aphids present, varying from minor levels to extremely heavy infestations.

Russian wheat aphids detected in the early stages of crop growth are mostly wingless. Aphids feed in dense colonies, typically at the base and sheath of the newest leaves.
(PHOTO: Mark Stevens, NSW DPI)

Populations of Russian wheat aphid in the Riverina crashed (almost completely) after the onset of hot weather. One commercial agronomist said that he saw the aphids persist a little into the late spring early summer, and he observed some in some aerially sown rice crops.

There have not been any reports of the aphids on mature crops, but the possibility of small numbers persisting though the summer in mature crops can't be ruled out.

Damage to crops

Aphids are usually a problem for crop plants as they suck sap from leaves and can be a vector for transmitting viral diseases. But Russian wheat aphid has another feature that leads to excessive damage in winter cereals – its saliva is toxic and causes significant damage to the plant.

Attack by this aphid causes characteristic streaking of the leaf, with red, white or yellow streaks, which is readily observed following aphid feeding. It also causes a 'cupping' of infested leaves, somewhat protecting it from predators and insecticide sprays.

The characteristic 'colour streaking' that Russian wheat aphid produces on winter cereals was not observed on rice crops in the region. Leaves of heavily infested seedlings tended to have damage that more closely resembled typical sucking insect damage – not unlike the symptoms of red-legged earth mites on winter cereals.

Most rice crops where aphids were observed were not overly affected – but there are some notable exceptions. Crops that experienced some other significant stress, such as herbicide damage (usually clomazone), were more prone to damage by the aphids. Often aphid populations in these crops were excessive (more than 10 per small rice seedling) and the plants did not appear to be able to withstand the sucking pressure.

Several crops were sprayed with an insecticide already registered for use in rice and known to control the aphids. The crops recovered relatively quickly once the aphids were controlled.

Overseas, Russian wheat aphid is a serious pest of cereal crops, especially wheat and barley, but there is almost no record of it infesting rice. It has been observed in the rice-growing Gulf States of the US for several decades but there are no public reports of it causing economic damage to rice crops.

Where did they come from?

The spring infestation of Russian wheat aphid was very widespread. Probably every drill-sown crop in the Murray Valley (and possibly the Murrumbidgee Valley) had Russian wheat aphid present. It was also amazing how quickly the aphids found the rice crops. They were observed on seedlings within a week of emergence.

Russian wheat aphid was detected in the Murray Valley last winter but not in big numbers, and only a few winter crops were actually treated.

The widespread and rapid infestation this spring implies that the aphids blew into the district, probably from infestations further

to the west. As conditions dried off over winter and early spring, winged aphids became airborne and were blown in our direction. Whether this will be an annual occurrence is as yet unknown.

Keep on the lookout

Growers are encouraged to remain on the lookout for Russian wheat aphid into the winter cropping season. It is expected that weeds in particular, and volunteer cereals, may host the pest over summer. This means paddock preparation for winter cereals should remove potential host plants (the green bridge) for a month before sowing.

While Russian wheat aphid is a relatively new pest of winter cereals in Australia, the population build-up in the NSW irrigation districts last spring was both surprising and alarming. It puts winter cereal growers 'on notice' to take precautions against the pest this autumn.

Growers should discuss the benefits of using a systemic insecticide treatment with their crop protection agronomist. They should also familiarise themselves with the symptoms of Russian wheat aphid on wheat and barley seedlings, and regularly monitor crops for the aphid.

John Fowler is the Senior Lands Services Officer, Extension Agronomist Murray Local Land Services, Deniliquin.

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Further information see: *www.irec.org.au* ■

Salt tolerant rice variety approved

NEXGEN Plants Pty Limited has received notification from the US Department of Agriculture (USDA) that its salt tolerant rice variety is non-genetically modified (non-GM) and does not fall under regulation requirements in the US.

The salt tolerant line has been developed using a non-GM breeding technology to introduce desired production traits into crops. It aims to help farmers worldwide to focus on selectively breeding stronger versions of crops and allows plants to develop strong defence responses to environmental pathogens or stresses.

This offers farmers the potential for improved yields, and plant breeding companies a unique competitive advantage for boosting seed and/or plant productivity and sales.

"Crop losses caused by environmental stress or pathogens such as viruses are a multi-billion dollar global problem. Nexgen Plants' technology provides a new proprietary intragenic (non-GM) breeding technique to deliver new traits, without ever introducing any foreign DNA," said Brian Ruddle, Managing Director of Nexgen Plants. "This allows us to use the plants own genetic material, modify it using our INTtrait approach – where no foreign DNA is incorporated into the plant – and then generate new varieties that exhibit disease resistance and other economically important traits. We are not replicating natural breeding – just speeding it up."

The USDA verification is another significant step in the commercialisation of the Nexgen breeding technology, since it successfully raised $2 million in early stage seed funding from Uniseed and Yuuwa Capital.

Investment in local research

"It's important that we begin to support, mentor and invest in more local research projects. This way all the important research that goes on in local universities can be transformed into real-world solutions through start-up companies and go on to help solve big problems facing Australia now and in the future," said Peter Devine, CEO, Uniseed.

The technology which underpins Nexgen Plants came out of Prof. Peer Schenk's research at the University of Queensland and was licensed to the start-up company by UniQuest, the commercialisation company of UQ."

Nexgen Plants is now awaiting confirmation from the Australian Government's Office of the Gene Technology Regulator, verifying that its salt tolerant line is not genetically modified.

"If the Committee confirms that Nexgen Plants' INTtrait technology does not need to be regulated, Australian rice farmers can look forward to improved salt tolerant varieties in the near future. Nexgen will then start work on a number of other disease problems facing Australian farmers," said Brian.

Nexgen Plants has recently completed two commercial contracts with global agricultural company, Syngenta and a major food and beverage multinational for virus resistance traits. ■

Professor Peer Schenk, Nexgen Plants Chief Technical Officer and Lara-Simone Pretorius in the Nexgen UQ research lab.

AUSTRALIAN START UP

Nexgen Plants, an Australian startup company developing resistance technology across a broad range of crop and virus types.

Nexgen uses the plants' own genetic material, modifies it using its INTtrait approach (where no foreign DNA is incorporated into the plant), and then generates new varieties with economically important traits.

The verification from the USDA represents a huge win for farmers worldwide, with stronger non-GM crops offering the potential for improved yields in environments with increased pathogens and other stresses.

Breakthrough technology features on new combine harvester

TAMMIN, WA, cropping farmer Hannes Joubert has used a few combine harvesters in his time but says breakthrough technology in the recently launched John Deere S700 series will lift grain quality and subsequently farmers' incomes.

A fan of John Deere, although he has many years of experience using other harvester brands, Hannes says he was surprised at the difference between the high-performing S600 series and the new harvester when his team trialled them recently. He puts the advancement down to the use of precision agriculture technology.

Hannes was born on a cropping farm in South Africa where his father was a third generation John Deere owner – but he's run a contracting business where he ran five machines of another brand – and over the years trialled many brands.

Twelve years ago he moved to Western Australia to manage the 11,000 hectare cropping operation 'Bungulla', a couple of hours inland from Perth on the Great Eastern Highway.

Bungulla harvests wheat, barley, canola oil, field peas and export hay. "That is where the love for the 'green machines' started. The technology and engineering is far superior to anything you can find out there," says Hannes.

Comparing the models

Bungulla runs three John Deere combine harvesters and wanted to trial the S700 against current models to see if there was much improvement. His team ran it alongside the S660 and S670 to compare performance on a wheat crop.

Hannes says the stand out improvement is camera technology enabling the operator to visually set specifications and have the harvester continue to work at an optimum level all day. Cameras provide pictures of the returns elevator, a live feed on the grain elevator and other views so the operator can see results during the harvest.

Sensors inside the grain box also consistently measure and weigh the grain yield. "You should get better control over quality of the grain. That's the most fantastic thing that this machine can bring you."

And with payment for grain based on the quality bracket achieved, that means higher returns for crop farmers, says Hannes.

The video technology was also a safety improvement because it negated the need for the operator to leave the cab to check the quality of the grain during the harvest.

Hannes says it's pleasing to see agricultural suppliers keeping up with precision technology and advancing their products with safety and better performance in mind.

The other big Improvement was a more operator-friendly cab, most important due to the long hours and hot conditions of the work.

The S700 series is the first to have a swivel seat with all the controls attached to the armrest, reducing stress on the driver from looking left and right a lot throughout the day.

From October to late December Bungulla operators work 14 to 16 hour days in a seven-day operation to complete the harvest before Christmas, often in 45 degree plus heat.

"You have got to give everybody the best work environment you can. We want to minimise driver fatigue and down time. And that meant making the job as comfortable and productive as possible for operators," he says.

Hannes Joubert manages 11,000 hectares of farming country two hours east of Perth.

Hannes gives the example of the previous series introducing fridges to the cabs. "It seems a very small thing but it makes a huge improvement in comfort."

Upgrading is worth the investment

Bungulla upgrades its harvesters every second season to keep within warranty, hold value and keep up with developing technology, and it's worth the investment says Hannes. "Basically harvesting is the ultimate reward for 12 months work. You have got to get it right."

For now Hannes Joubert has his sights on getting one or two of the S700 series this year. "We are very much in love with it".

Hannes says John Deere offers support through several dealerships in Western Australia and Bungulla is fortunate to have one only 20 km from the property where there's good support if issues arise. "It is almost a friendship relationship – it is not a business relationship." ■

Improved varieties helping make cotton viable at Forbes

THE improvement in varieties and technology has made cotton a viable option on the property 'Kywong' owned and operated by Robert Scott, south-west of Forbes, NSW, in the Jemalong irrigation district.

Robert said they previously grew corn on their irrigation country but last season switched to their first-ever year of cotton.

"It was the improvements in the technology and the varieties," he said. "The introduction of varieties such as Sicot 746B3F now suit this climate and it was worth considering growing cotton. The gross margins certainly make it worth doing.

"The weed control is fantastic and being a corn crop last year, there were volunteer corn plants that came up through the year. An application of Roundup tidied those up and any other problem weeds."

He said the first year success means they will grow cotton again if water is available.

Cotton maximises everything you give it

"What I like about the crop is the way it maximises or optimises everything you give it – the sunlight, the water, the fertiliser, the agronomy – if you can get the package right then it will perform."

He said communication with their neighbours about their intention to grow the crop and the need to avoid spray drift was paramount during the growing season.

"I've been very open with everybody for twelve months to make sure everybody knew what I was doing. Because cotton is new to the area it's going to take a while for it to be fully accepted and for everybody to become educated about their spraying. The immediate neighbours have been positive."

Preparation was a key to growing the crop with time spent in lasering paddocks and setting up infrastructure with channels and drainage.

"If you are going to irrigate you have to be able to deliver the water," Robert said. "You also have to be able to get it off the paddock and drainage is just as important as delivery."

The 120 hectares of cotton was planted in the second week of October and irrigated up in the week that followed.

"We have a local agronomist who is specialising in cotton and he's monitoring the crop twice a week and he's using other technologies, satellite imagery, moisture probes and soil testing. He has the experience and knows what is required so I am relying on his advice."

Robert said return per hectare was fundamental in growing irrigated crop. Water use of 9.0 megalitres per hectare was needed last season.

"It is a longer season crop than I am used to growing so the last watering took us into March, with harvest by the end of April."

The enterprise relies on contractors for all specialist machinery which includes hilling up, fertilising, sowing, the laser levelling and any other earthworks.

For cotton, harvest pickers have come through from more northern regions and gins are available at Trangie in the north and Griffith in the south. ■

Robert Scott, of Forbes, NSW, switched to cotton last season due to the improvements in varieties and technology.

Rethink your duals

TRACTORS are heavier and more powerful than ever before, and as a result, issues associated with soil compaction are becoming an increasingly common problem. Despite this, many continue to run tyres that only worsen the problem – whether by choice or perceived lack of other options. But there are options out there, and growers need to fight for their right to float.

"It's all about the footprint. Think about it this way – if you walk out into the field on ice skates, you're going to sink right into the mud. With boots, you're good to go," says Scott Sloan, agricultural product manager for Titan International and Goodyear Farm Tyres. "I don't see too many guys walking around the field in ice skates, but I do see a lot of guys running narrow duals when they don't need to. If you're not running the machine between the rows post-emergence, then there's really no reason you shouldn't be running extreme flotation tyres."

A recent study revealed that only about 37 per cent of American growers have a need to frequently run between the rows postemergence. These 37 per cent are the good candidates for running narrow duals on their tractors. But an estimated 75 per cent of mechanical front wheel drive (MFWD) tractors still come from the factory with narrow duals. This means a large percentage of growers are running duals when it's unnecessary. Low sidewall (LSW) technology is also gaining traction in the Australian market with a number of LSW tyres already fitted to MFWD tractors and self-propelled sprayers.

The low sidewall advantage

In addition to spreading far less pressure over a much wider footprint (and thus causing less soil compaction), the added stability of LSW technology provides many other benefits to running extreme flotation tyres. LSW technology features a larger wheel diameter and smaller sidewall than a conventional tire. This decreases the likelihood for sidewall recoil, which drastically improves ride quality and stability, and reduces power hop and road lope.

To learn more about the advantages LSW tyres can bring to your farming, contact Titan Australia on 1300 791 672 or email sales@titanaustralia.com ■

Approval for breakthrough fungicide

AT A GLANCE...

- Miravis, an Adepidyn based product, is now registered in Australia for canola, potatoes and grapes;
- Miravis is the umbrella brand name under which Adepidyn based crop protection products will be marketed;
- Miravis offers a significant improvement in control versus industry standards for blackleg in canola; and,
- Miravis has received registration from the APVMA.

MIRAVIS is expected to significantly benefit Australian canola, potato and grape growers, according to Syngenta Product Lead for Miravis in Australia, Leandro Posteraro.

"Miravis offers a significant improvement in control versus industry standards for blackleg in canola, early blight (Alternaria) in potatoes and powdery mildew in grapes," Leandro said.

"These three pathogens are among the most common disease challenges growers face in the respective crops, and we have seen that Miravis delivers a powerful solution.

"Local field trials have demonstrated impressive results that will translate to a strong return on investment for growers in commercial crops.

"Miravis visibly delivers powerful and dependable performance that you can see when you walk into the crop."

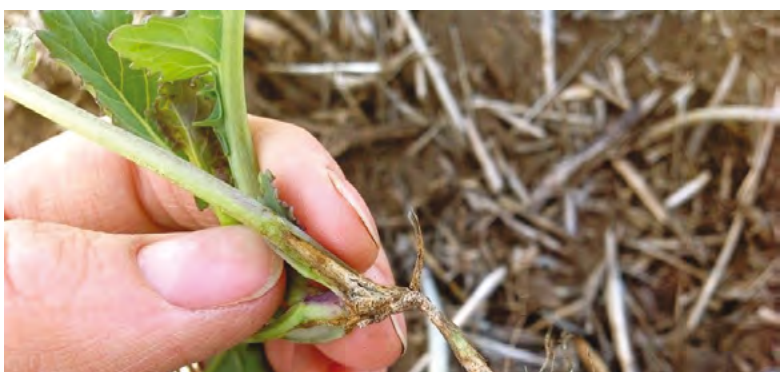
Syngenta Territory Head – Australasia, Paul Luxton, said Miravis is another example of Syngenta bringing innovative new technology to the Australian market to benefit local growers.

"Miravis is a global product that we have locally tried and tested in Australian conditions," Paul said.

"This focus on local research and development delivers to Australian growers a world-class solution that is locally relevant and environmentally proven."

"This is part of our broader focus of being a research and development leader in Australia to help growers produce crops more efficiently with greater yield outcomes."

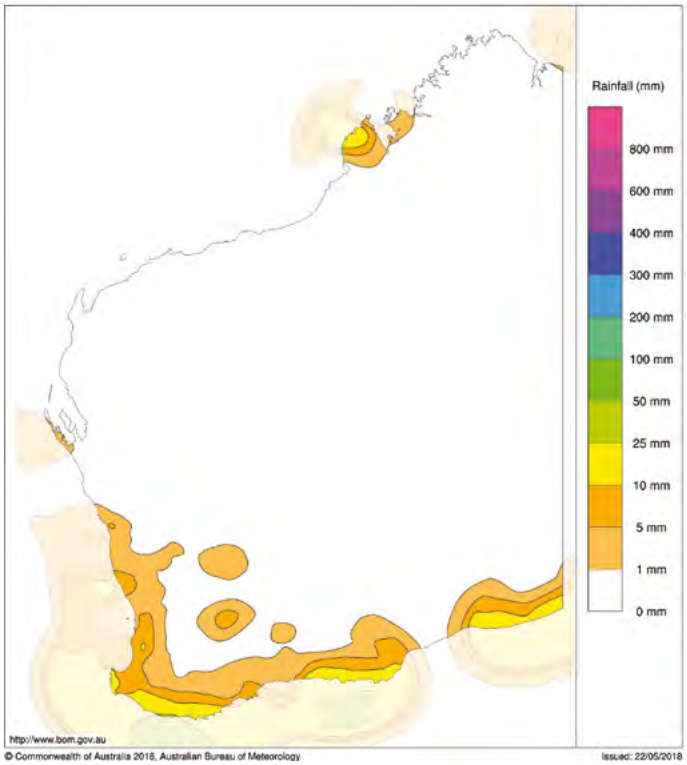
First sales are expected in the 2018 canola season in Australia. ■



A new fungicide for blackleg control in canola has received APVMA registration.

Western region

Western Australia rainfall totals (mm) May 1–22, 2018
Australian Bureau of Meteorology



The Western Australian cropping regions have experienced a very dry May.

WESTERN AUSTRALIA SUMMARY

The dry conditions across most of the grain growing regions of Western Australia continue with most of the state waiting for a general break to the season.

Isolated pockets of early sown canola, lupin and to a lesser extent cereals are up in the eastern, south coastal and Esperance regions with most paddocks patchy due to the lack of follow up rain

There has been widespread wind damage to emerged crops and paddocks where stubble was not anchored in the southern regions from a severe wind event early May.

The area of canola will be down from last year due to the lack of rain with most of these paddocks being substituted for barley. As a result of this, the estimated barley area has increased.

The wheat area remains unchanged as there is still a large proportion of the wheat area to be planted. Most growers recognise it is still early days and are not rushing things.

The expected lupin and oat areas are lower than earlier forecasts with the final area sown expected to become more accurate by the end of May.

The area sown to legume pasture has increased significantly reflecting the improved profitability of sheep.

GIWA crop area estimates (ha) for WA for 2018

- Wheat 4,850,000
- Barley 1,530,000
- Canola 1,200,000
- Oats 290,000
- Lupins 360,000
- Pulses 34,000
- WA state total 8,264,000 hectares

Estimates based on conditions at May 11, 2018.

GIWA gratefully acknowledges the support of DPIRD, CBH and contributions from independent agricultural consultants and agronomists in the production of this report.

GIWA Crop Report – May 11, 2017

NORTHERN DISTRICT

Generally the landscape has been dry since the mid January rains. Summer weed control kept most growers very busy through February and March. There was some mopping up carried out in April.

Most growers are now well through their crop planting. Some will finish next week and some growers close to the coast and with livestock enterprises are just getting underway. On average, the crop would be over 50 per cent planted at mid-May.

Many sandplain growers have deep ripped paddocks that are lacking cover and won't be planted until they are wet. Otherwise, many growers will finish their seeding program by the end of May.

Some growers have stopped and are waiting on rain or a solid forecast before continuing. This is to keep options open (for not planting) if the season does start very late.

All we need now is rain. Looks like the first chance will be next week. Hopefully Hughie delivers!

Peter Norris
Agronomy For Profit and Synergy Consulting, Geraldton
May 17, 2018

SOUTH COAST

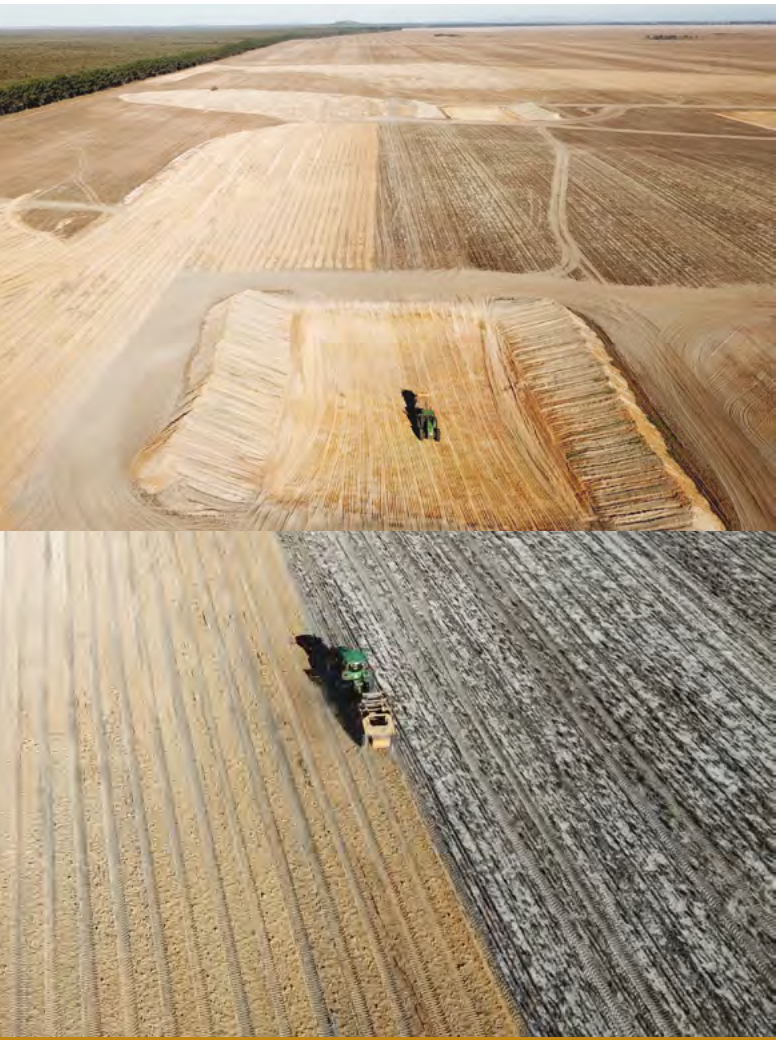
Seasonal conditions on the South Coast for the past two months have been dry. Some areas within 25 km of the coast have received some useful rain to germinate crop while other inland areas wait patiently for an opening rain.

AGT Longsword winter wheat sown April 10 at Lobethal, east of Condingup showing the benefit of taking advantage of early seeding opportunities with long season wheats.

District Reports...

May–June 2018

Southern region



Clay spreading non wetting sands on the Warakirri property, 'Lobethal' to the east of Condingup. (PHOTOS: Quenten Knight)

Most growers have started dry seeding. Fortunately large areas of the South Coast received good rain in February which on duplex soils (sand over clay) has conserved moisture close enough to the surface to germinate and establish cereal crops if seeded slightly deeper than normal.

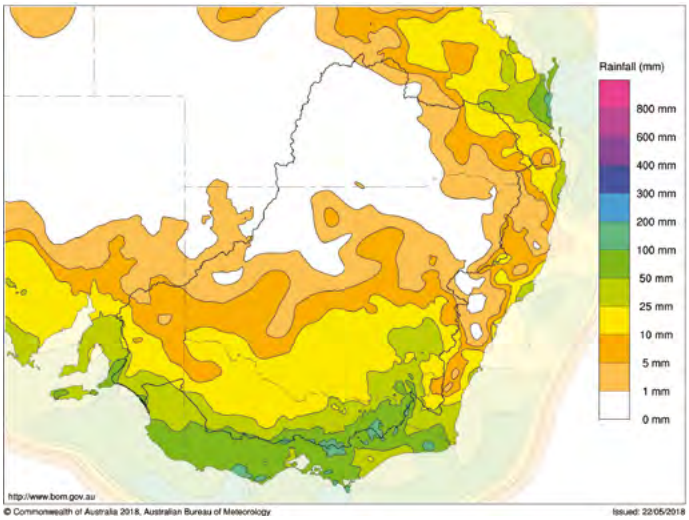
For other soil types the moisture is just out of reach – nothing a good 10–15 mm rainfall event wouldn't fix.

With a later break, paddocks are well prepared for seeding. Growers have been able to spend more time on soil amelioration projects that include clay spreading, clay delving, deep ripping, lime and gypsum spreading and even surface drainage in anticipation of wetter times ahead during 2018 (see photos).

Growers are keeping optimistic about season 2018 as the region has good stored soil moisture levels that should hold us in good stead later in the season.

Quenten Knight
Agronomist, Precision Agronomics Australia, Esperance
May 15, 2018

Murray–Darling Basin rainfall totals (mm) May 1–22, 2018
Australian Bureau of Meteorology



By late May only the 'higher rainfall' cropping zones of the Murray Darling Basin had received reasonable planting rain.

VICTORIAN MALLEE

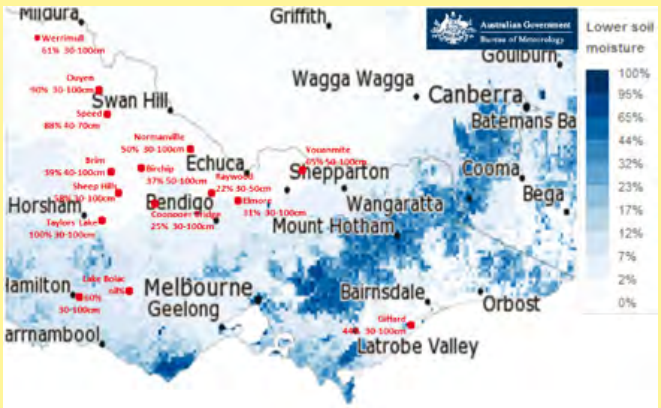
Growers across the Mallee are getting close to concluding their sowing program and parking the seeder in the shed for 2018. After a long dry summer and early autumn period there has been some relief with falls of 10–14 mm in early May which has germinated crops sown close to this rainfall.

To May 15, the annual rainfall across the region according to the BoM weather stations are 36 mm for Swan Hill, 23.6 mm for Mildura, 26 mm for Ouyen, 49 mm for Kerang and 25 mm for Birchip.

Although this may seem low for most pockets of the Mallee, according to the Agriculture Victoria soil moisture probes network there is between 37–90 per cent moisture at depth at approximately 30–100 cm (Figure 1), depending on your location.

The current forecast from the Bureau of Meteorology is for conditions to be neutral for the next three-month period, meaning there is an equal chance of achieving above or below average rainfall.

FIGURE 1: Agriculture Victoria soil moisture probe network, May 2018



As a result, anecdotal evidence has suggested some reassessment of farm business risk profiles in relation to the amount of area sown to high value crops such as canola and pulses.

Mouse numbers are variable but are creating enough angst that all farmers are being vigilant and baiting in sync with sowing. Constant monitoring of paddocks for active holes is recommended, especially in emerged crops and priority is being given to high value crops such as canola and pulses.

As crops have and continue to emerge, post emergent sprays will be occurring. Due to the dry spell prior to sowing, there were few summer weeds and therefore no opportunity to achieve a knockdown. This may lead to some instances later in the season of 'wharley', but this will be depending on the spraying/emergent spraying opportunities.

Other considerations include careful planning of sheep feed and its availability as feed grain is getting a little scarce due to a dry summer and lots of feeding out. Growers are maintaining adequate hay for feeding out to sheep but are shifting some stocks to prop up cash flow and avoid housing mice throughout the season.

Ciara Cullen
BCG Extension Manager, Birchip
May 21, 2018

Northern region

LIVERPOOL PLAINS

It has been an incredibly dry summer and around the Liverpool Plains district with some areas seeing the driest season on record.

The lack of rain has been no help to farmers who are set up for only supplemented irrigation although there are some surprisingly good dryland cotton in areas with later planted crops. One benefit of the dry weather has been great harvesting and picking conditions.

On our farm

After following through after the chickpea crop we have had a dry summer season, which has turned out to be an easy summer

Winter crop sowing is coming to a close in the Mallee. (PHOTO: Gen Clarke, BCG)

District Reports...

as far as spraying is concerned. With little rain there has been few opportunities for weeds to grow.

At this stage we have dropped Dhurum wheat out of the rotation and will follow through to summer planting sorghum. We therefore hope the price stays firm in what might be a higher than average summer crop plant in 2019. This is due to the lack of autumn rain which means winter planting will be down around the district. We intend to continue with multi variety planting and fine tuning our soil zones.

David and Lauren McGavin
Precision Seeding Solutions, Premer, NSW
May 20, 2018

DARLING DOWNS

Weather conditions

The second half of summer has been described as brutal, and crops have definitely suffered from the dry and the heat. There were some falls of rain in late February and early March but very few over 20 mm, and apart from a few localised exceptions, April and May have been extremely dry with less than 10 mm over the two months for many farms. This has left many paddocks very short of stored moisture approaching the winter season.

Summer crop

The early planted sorghum yields were disappointing in both yield and quality, but those crops planted in December have performed better. Yields have depended on stored moisture and catching the storms, and whilst the average dryland yield was around 5 tonnes per hectare, there have been some crops of 7.5 tonnes per hectare. January planted crops though have struggled to yield 3 to 5 tonnes.

Corn has suffered from fusarium this summer and cases of silk balling, preventing fertilisation of the cob, which has reduced yields. Silage crops have struggled to yield more than 40 tonnes per hectare with the harsh season.

The best mungbean crops were those on long fallow ground planted in later January with yields up to 2 tonnes per hectare, but other crops have been as low as 0.3 tonnes. The average yield has been between 0.6–1.0 tonnes per hectare, with many crops struggling to fix nitrogen with the heat of the soil. But the odd irrigated mungbean crop has yielded up to 2.5 tonnes per hectare for a good return.

A few soybean crops were planted but needed irrigation to perform, with some good yields up to 3.7 tonnes per hectare.

Dryland cotton was disappointing with 1 to 5 bales per hectare being achieved, but irrigated crops have enjoyed the season, with many crops of 10 to 15 bales per hectare – and coupled with prices over $600 per bale – cotton has given some of the best returns this summer.

A rare paddock of emerging barley on the Darling Downs this autumn.

Winter outlook

There are very few paddocks on the eastern half of the Downs with good stored moisture, but to the west there have been more showers. In the Chinchilla region chickpeas and barley have been planted across a fair area, whilst around Dalby planting is only possible in small pockets, with some growers deep planting.

District Reports...

Some good looking late planted sorghum still to be harvested on the eastern Downs.

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)	2018 rainfall to date (mm)	Summer 25yr Annual Average (mm)	Summer 2017–18	Autumn 25yr Annual Average (mm)	Autumn 2018 to date	Winter 25yr Annual Average (mm)	Winter 2017	Spring 25yr Annual Average (mm)	Spring 2017
Emerald Qld	561	269	251	330	105	21	69	16	127	190
Toowoomba Qld	675	279	269	302	138	80	88	64	179	177
Roma Qld	581	219	251	208	116	94	78	40	135	163
Goondiwindi Qld	623	124	254	113	122	62	102	54	145	191
Narrabri NSW	631	124	220	95	118	66	130	73	164	126
Gunnedah NSW	634	85	217	118	108	34	129	74	183	185
Dubbo NSW	604	45	190	85	127	14	133	33	157	124
West Wyalong NSW	454	74	119	156	80	36	124	75	131	66
Wagga Wagga NSW	540	108	133	177	111	33	150	105	140	111
Swan Hill Vic	317	36	71	69	65	20	87	68	95	91
Bendigo Vic	504	70	109	60	106	47	159	124	135	106
Horsham Vic	374	57	79	43	71	40	122	114	104	116
Lake Bolac Vic	515	109	114	66	101	90	153	119	148	179
Murray Bridge SA	364	41	70	64	79	27	121	102	97	75
Kadina SA	336	26	63	60	78	7	112	71	85	60
Cummins SA	388	73	55	49	88	50	170	164	78	75
Esperance WA	614	115	88	75	141	49	248	219	138	128
Wagin WA	397	71	50	62	97	25	163	163	87	79
Northam WA	401	89	47	97	88	6	185	169	80	64
Mingenew WA	347	72	30	75	89	0	170	108	58	44
Moora WA	382	81	43	88	85	9	185	200	69	63
Mullewa WA	321	88	53	88	93	26	130	134	45	34

Last rainfall reading May 18, 2018.

District Reports...

May–June 2018

For the Pittsworth region, the only planting opportunity is under irrigation.

The chickpea area will be well down this winter – possibly by as much as 70 per cent from the record plantings of the past two winters.

Taking up the slack will be wheat and barley, with strong prices and the desire for stubble cover leading to an expected doubling or more of last winter's area.

But 2018–19 sorghum contracts with prices over $300 per tonne are persuading some growers to change their rotation to plan sorghum instead of a winter crop.

An old issue is making a return, with mouse numbers building significantly over the past six weeks, and growers are having to monitor and bait prospective paddocks.

Overall everyone is waiting for rain, and with models predicting dry conditions until nearer mid-June, we are looking at a later than usual winter plant.

Hugh Reardon-Smith
Agronomist – Landmark, Pittsworth
May 18, 2018

A terrific looking crop of irrigated cotton on the Darling Downs. The crop went on to yield 13 bales per hectare.

ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The mystery tractor is a 1954 Lanz Bulldog D1706 equipped with a Bosch pendulum starter motor and a powered down thrust three point linkage, both fitted as standard. Restored by the author.

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