



AUSTRALIAN GRAIN

JULY–AUGUST 2014

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INSIDE

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resistance
and
wild oats**

**Cabbage
aphids
living on
the edge**



**Underground
dams for
drought proofing
the nation**

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FRONT COVER

Frank Demden from Precision Agronomics Australia launches the company's eBee UAV drone to measure normalised difference vegetation indices (NDVI) in a Nitrogen



Rate Response Trial in long term controlled traffic farming at Scaddan on the South Coast of Western Australia. (Photo: Quenten Knight)

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As a nation of largely disparate commentators on farming matters, we've been banging on for a long time now about how a cashed-up and hungry Asia is going to be Australian agriculture's *White Knight* gallantly protecting our farmers from the evils of poor commodity prices and uncertain markets. Ever so slowly we are seeing some sectors of some industries – such as dairy – starting to enjoy the tangible benefits (read here: better prices) of increased demand coming out of Asia. But progress has been at best piecemeal and way too slow for many farmers carrying high debt loads.



To continue with the *White Knight* analogy, Andrew 'Twiggy' Forrest of Fortescue Metals fame and more recently, the Munderoo (beef) Group, is tired of waiting around for rescue from Asia. He has just galloped onto the international agricultural commodity scene on a white charger Twiggy calls 'ASAP' to underline the urgency of this initiative. But more formally – the Australia Sino 100 Year Agricultural and Food Safety Partnership – has the 'ASA 100' moniker.

Twiggy has a vision to build on the already very close and extensive Australia–China resource trading relationship and to elevate our high quality farm commodities as the grain/meat/fibre/dairy products of choice for Chinese consumers. And he sees ASA 100 as an important vehicle in achieving this.

In Sydney in late July, Twiggy gathered together agricultural ministers and major food producers and distributors from Australia and China for the first meeting of ASA 100. The meeting was largely about how to get things done, rather than just talk about it.

Essentially, Twiggy's idea is to make sure there is a collaborative and cohesive leadership framework in place so that the Australian agricultural industry – and its products – will be marketed to China as one common and united brand, under one single logo.

He draws on his experience gained in the early days of trying to sell (Fortescue Metals) iron ore to the Chinese. Twiggy remembers how Australian companies and state governments were so fixated on competing amongst themselves that "we dropped the ball" allowing Brazil to take a large slab of the Chinese market. China has become used to dealing with Australian companies and governments competing against each other.

You get the feeling that Twiggy is not a fan of empty platitudes. He's already signed up three of China's biggest food companies to the initiative. Ultimately, the ASA 100 structure will comprise 50 members from each country who will meet regularly.

We are a country dependent on exports and very few sectors of our economy will benefit more than agriculture if there is a more stable and long-term international demand for our high quality and safe products. With ASA 100, Twiggy Forrest is doing his level best to improve the lot of Australian farmers and to rekindle the passion for on-farm and agribusiness investment.

Any Australian agricultural industry which benefits from higher and more stable long-term prices for their products, particularly exports – and that pretty much covers every Australian farmer – could do a lot worse than have Twiggy as their champion.



AUSTRALIAN GRAIN

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In this issue...

Wild oats: Could we manage without selective post-emergents?

In the 1980s and 90s, all grain growing regions of Australia were generally dependent on selective post-emergent herbicides to treat grass weeds like annual ryegrass and wild oats in cereal crops. Little thought was given to other control tactics.



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Whacking weeds organically

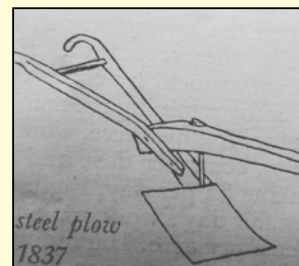
It can take real grit to control tenacious weeds. Although determination is an important attribute in farmers, ARS agronomist Frank Forcella is counting on grit of another kind in his approach to battling weeds.



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John Deere – the man

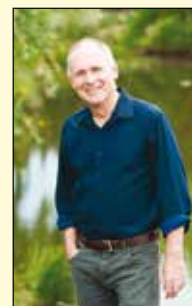
The astonishing versatility of genetically modified seeds, quantum leaps in the capabilities of herbicides and weedicides, new approaches to the necessity of protecting the integrity of our soil structure by the utilisation of no or low till practices, are all simply a part of today's global farming scene. None of which of course would be of relevance had there not also been a continuance of the evolution of farm mechanisation.



See article Page 21

Drought proof with underground dams

Underground dams offer a promising way to make Australia's number one foodbowl, the Murray-Darling Basin more resilient against droughts. Professor Tony Jakeman says his group's research shows there is good potential to store water underground during time of flood – for use in time of drought.



See article Page 28

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Australian Grain — 5

Wild oats: Could we manage without selective post-emergents?

IN the 1980s and 90s, all grain growing regions of Australia were generally dependent on selective post-emergent herbicides to treat grass weeds like annual ryegrass and wild oats in cereal crops. Little thought was given to other control tactics.

Wild oats and annual ryegrass are frequently found in the same paddock and therefore are exposed to the same herbicide treatments. Ryegrass rapidly evolved herbicide resistance while wild oats has been slower to develop resistance, due mainly to differences in plant physiology. Wild oats is self-pollinating while ryegrass is a cross-pollinating species and although this difference has slowed the evolution of resistance, there are now wild oats populations that are resistant to all post-emergent herbicides registered for its control.

Wild oats is considered the second most important grass weed worldwide and is present in all Australian temperate cropping zones. Once resistance has established in a population of wild oats there are less non-herbicide control options available and the available herbicide groups are rapidly running out due to their over-use, particularly in winter-only cropping systems.

Surveys and observations in the northern and western cropping region indicate that multiple resistance to Group A, B and Z (all the available post emergent chemistry) is increasing.

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To date there has been no resistance to glyphosate or paraquat identified in wild oats.

Harvest weed seed control tactics are less effective on wild oats than on other species because it begins to drop seed before the crop is ready for harvest – but crop competition is an effective non-herbicide tactic.

In a long-term Agriculture and Agri-Food Canada trial from 2001 to 2009, crop competition, crop rotation and full herbicide rate combined to drive the wild oats seedbank to zero. The wild oats in the trial plots had only low level herbicide resistance. But another trial in the US indicated that multi-resistant wild oats and herbicide susceptible wild oats both decrease in response to crop competition from wheat, with no difference in the growth rate and biomass production of the plants that survive in the absence of herbicide.

These trials indicate that non-herbicide treatments such as crop competition are effective against both resistant and susceptible wild oats populations and should be considered as part of the management strategy for this weed.

Wild oats decline attributed to pre-emergents

AHRI leader of communication, Peter Newman, believes that the decline in the presence and severity of wild oats populations in Western Australia is due to growers' use of pre-emergent herbicides from Groups D and J.

"Western Australian growers have less problems with wild oats now than they did ten years ago," said Peter. "I believe that

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TABLE 1: Summary of key research findings of Canadian researchers John O'Donovan and Neil Harker from Agriculture and Agri-food Canada from the Beaverlodge site. Wild oat seed bank was measured by taking soil core samples and sieving in 2009.

Herbicide rate %	Barley seeding rate ¹	Crop rotation ²	Wild oat seedbank in 2009 (seeds/m ²)	Barley yield in 2009 (kg/ha)
25	low	continuous barley	3640	2310
25	high	diverse rotation	1560	3720
50	low	continuous barley	2730	2600
50	high	diverse rotation	195	5130
100	low	continuous barley	37	4340
100	high	diverse rotation	0	5020

1 low=200 seeds/m² (normal) high=400 seeds/m²
2 diverse rotation=barley-canola-barley-field pea

the use of pre-emergent herbicides as a standard practice every year has helped drive down the weed seed bank."

DPI NSW weeds technical specialist, Tony Cook, agrees that pre-emergent herbicides need to be used more to help reduce the impact of this difficult-to-control weed. "This does raise the risk of other species being exposed to pre-emergent chemistry and the associated risk of developing resistance," he said. "In the northern region the most reliable way to reduce wild oats populations is through two consecutive weed-free winter fallows."

"This is most easily achieved where summer cropping is an option. In winter-only cropping areas this might be difficult for growers to implement across their whole farm but could be considered as a patch management tactic where densely populated areas could be taken out of production and kept weed-free."

Prolific seed producer

Wild oats is a prolific seed producer, with over 300 seeds usually produced per plant, but the seed does not remain viable in the soil for very long so implementing consecutive fallow treatments is known to reduce the seed bank to very low levels.

In the drier western regions of NSW and Queensland Tony suggests growers consider the option of taking badly affected paddocks out of production to allow winter fallow treatment with knock-down herbicides and non-herbicide tactics, including cultivation.

"Another option would be to grow silage or hay crops or establish a pasture to allow the use of other herbicides or the harvesting of the crop before the wild oats produce viable seed," he said. "The continued use of boom spray applications of post-emergent herbicides strongly favours herbicide resistant wild oats populations and this will have significant impacts on crop yields."

"Suppressing germination and early growth of wild oats with pre-emergent herbicides will help because 85 to 90 per cent of the wild oats seed from the previous season will germinate with the sown crop," said Tony.

In chickpea crops the use of inter-row cultivation or wiping the wild oats plants that stand above the chickpea crop with glyphosate before seeding could also be considered.

It is imperative to ensure that herbicide resistance testing of wild oats plants is a high priority, particularly those plants that appear to have survived a herbicide treatment. It is important to identify the herbicides that the plants are still susceptible to.

Herbicide resistance is a trait perpetuated by seed. Stopping seed set and controlling survivors of all weed control measures are core tactics in the battle against herbicide resistance.

For more information on managing the risk of herbicide resistance, visit www.weedsmart.org.au

DIVERSITY CAN'T WAIT

Bayer CropScience is helping growers manage herbicide resistance with the launch of their new Diversity Can't Wait website. Designed to educate growers on the importance of weed management diversity in broadacre cropping systems, the website will detail how growers can utilise different strategies to manage herbicide resistant weeds or delay the onset of resistance all together.

Lisa Mayer, Project Manager WeedSmart, said the site is an easily accessible tool that will help guide farmers.

"Herbicide resistance can have a significant effect on a grower's yield and the unique value of this database is that it gives users access to information in one convenient location," said Lisa.

Although the development of resistance cannot be totally prevented or reversed in a herbicide based weed management system, a good balance of chemical, cultural and mechanical management practices can slow and manage its impact.

"The benefit of this particular site is that it doesn't focus exclusively on managing resistant weed populations through herbicides, it offers a broad range of tactics," said AHRI Communications Team Member, Peter Newman.

Resistance to herbicides continues to grow in Australia with 68 confirmed resistant biotypes identified in 2014 – up from 28 in 2008.

Stuart McLaverty, Portfolio Manager Broadacre Rice & SeedGrowth at Bayer CropScience, said by introducing a diverse weed management system now, growers could potentially limit or delay resistance to their existing herbicide options.

"By incorporating herbicides with different modes of action into their weed management program – along with a number of cultural practices – growers will be able maintain the effectiveness of the older chemistry for a longer period of time," said Stuart.

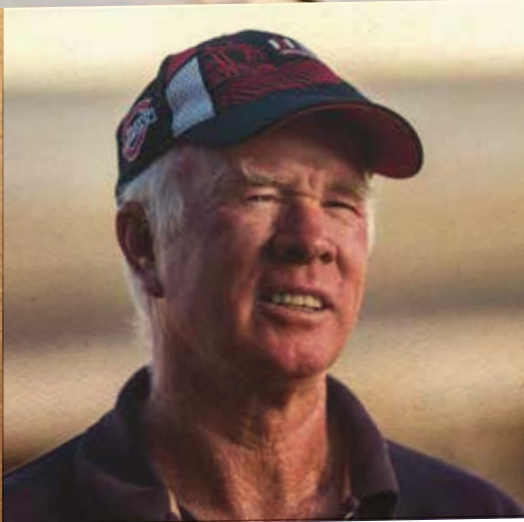
Growers can also learn more about the status of herbicide resistance on their farm by collecting and testing weeds seeds prior to crop harvest. To encourage this Bayer will be offering a limited number of free herbicide resistance tests later this year.

To learn more about the herbicide resistance tests, the development and extent of herbicide resistance and the strategies you can employ to delay its onset, visit www.diversitycantwait.com.au

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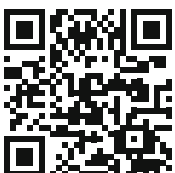
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Getting the jump on herbicide resistant weeds

FORWARD thinking grain growers in NSW have recognised the serious nature of herbicide resistance in weeds and are determined to meet the challenge head on.

In the past two or three years Mitchell Hughes – assistant manager at Hermiston Ag Enterprises – has witnessed an increase in the number of weeds surviving herbicide applications on the company's farms across the Riverina.

Mitchell manages Hermiston Ag Enterprises' dryland cropping and prime lamb operations and said their continuous cropping system with stubble retention and a chemical fallow had increased their risk of weeds becoming herbicide resistant.

"We have Group A and Group B resistance suspected in ryegrass and wild oats and are noticing an increase in fleabane and wild radish in some years," he said. "We started tackling the problem by using Roundup Ready canola to allow us to treat ryegrass in-crop but we recognise that this is a short term fix. We are keen to adopt other strategies that can reduce the size of the herbicide resistant populations of weeds in our paddocks."

Lessons from WA

Along with 130 or more other concerned farmers from Moree to Wagga Wagga, Mitchell attended one of the recent Integrated Weed Management workshops featuring researchers and growers from Western Australia who have been developing strategies to combat herbicide resistance for decades.

Discussion leaders at the workshops included John Cameron, ICAN Rural, Tony Cook, NSW DPI and Peter Newman, Australian Herbicide Resistance Initiative, along with WA grower Ray Harrington.

Local growers, Tom Murphy, Murray Scholtz and grower and researcher Maurie Street were also on hand to discuss their personal experience managing resistant weeds. Each have trialled several strategies as they look for the most effective mix of tactics to meet the herbicide resistance challenge.

As NSW DPI extension officer, Tony Cook explains there is great value in learning from the experience in Western Australia.

"Although there are some differences in crops grown and the types of weeds present, the path to herbicide resistance is fairly predictable," he said. "Ignoring survivors, allowing them to set seed and re-treating each year all hasten the evolution of herbicide resistance."

"In Western Australia growers have nearly lost the use of all



Mitchell Hughes is looking to increase crop competitiveness and use narrow windrow burning to drive down the weed seed bank on the dryland cropping farms he manages for Hermiston Ag Enterprises.



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herbicide groups and have been forced to adopt non-herbicide weed management tactics. In the east, herbicide resistance is not as severe and growers have the opportunity to act decisively to preserve the efficacy of existing herbicides."

Tony warned that the opportunity will only exist for a relatively short period of time and that the cost of inaction is enormous – as Western Australian growers know all too well.

After attending the Wagga Wagga workshop, Mitchell has returned to his farm ready to implement several new strategies.

"Some of the tactics explained at the workshop are easy to adopt," he said. "In the first place we plan to do everything we can to increase the competitiveness of our winter crops this year. We also plan to windrow burn in our worst paddocks to start the process of reducing the weed seed bank."

"To increase crop competition the researchers recommended increasing the sowing rate, paying more attention to crop nutrition and planting east-west," said Mitchell. "These are all things we can implement immediately. Another suggestion is to reduce row spacing and while we are open to trying that it will not be something we could change straight away."

Stubble burning has been used on Hermiston Ag Enterprises farms in the past as a management tool, particularly on the higher rainfall country. Mitchell said these were the farms with the greatest weed problems and so were the best place to trial narrow windrow burning.

"Narrow windrow burning can kill 90 per cent of the weed seed present after harvest," Mitchell said. "For a cost of less than a thousand dollars to build the modified chute and a little more labour this is a low cost option that we can easily implement."

In the fallow Mitchell plans to take much more notice of the efficacy of every herbicide application. "We will be trying hard to get onto weeds when they are small and more likely to be killed,

even if they are actually herbicide resistant," he said. "After each application we will be looking at the effect and doing whatever we can to remove any surviving weeds."

For more information on managing the risk of herbicide resistance, visit www.weedsmart.org.au



Hermiston Ag Enterprises farm manager, Mitchell Hughes, discusses his plans to implement a range of strategies to combat herbicide resistance with NSW DPI Technical Specialist Weeds, Tony Cook.

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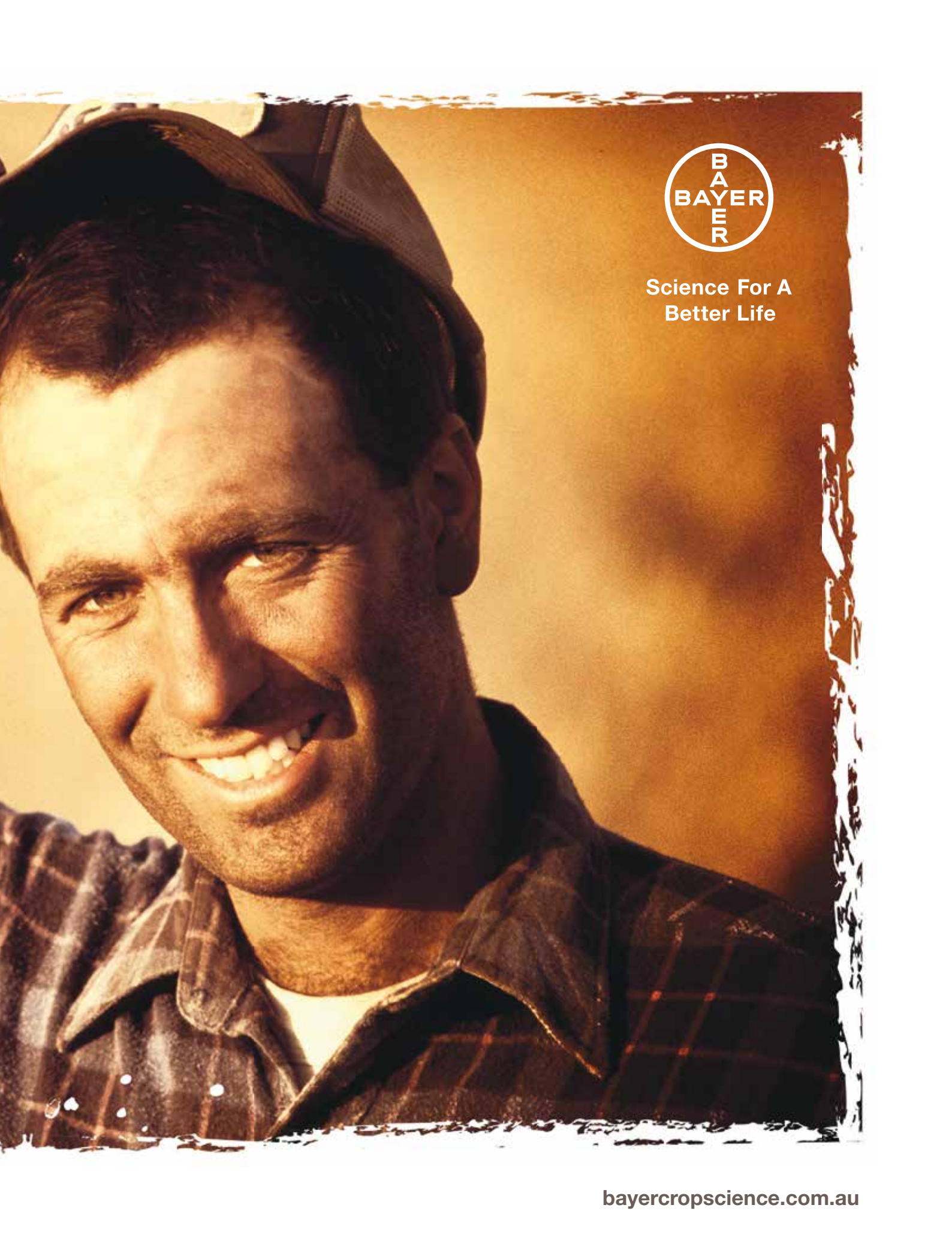
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What has pure research ever done for us?

■ By Australian Herbicide Resistance Initiative

IN 1974, physicist John O'Sullivan developed a mathematical tool to detect black holes. He didn't find the black holes, but nearly 20 years later while working at CSIRO in Australia, he used this research to develop Wi-Fi. CSIRO went on to receive royalty payments of hundreds of millions of dollars for this unexpected consequence of early, pure research.

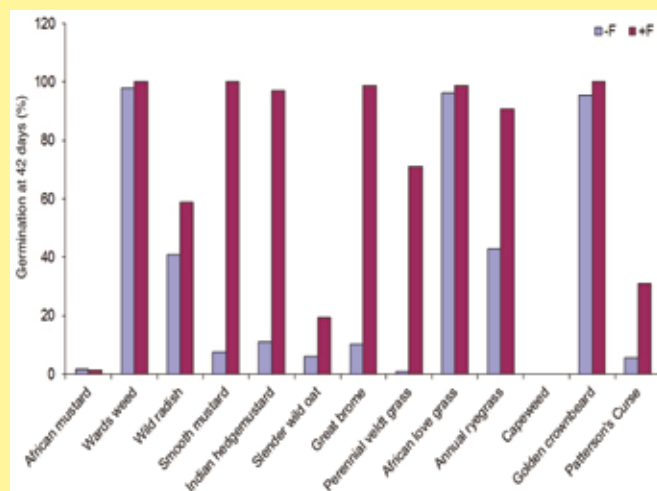
AHRI researcher Dr Danica Goggin works at the pure research level and she has also made an unexpected discovery.

Danica was using an aquatic herbicide, Fluridone, to break dormancy and stimulate ryegrass germination. But this is not new, she found that it also killed the ryegrass. Further research revealed that Fluridone stimulated germination in eight weed species including wild radish and brome grass. Fluridone was not tolerated by wheat, canola, common beans or chickpeas, but lupins and field peas grew normally.

We must keep in mind that this is pure research and is still at the laboratory proof of concept stage. It may not be as big as Wi-Fi, but pure research to evaluate an aquatic herbicide in a field situation to stimulate a 90 per cent weed germination and then kill nearly 100 per cent of the weeds is a classic example of where investment in pure research is necessary.

Once in a while unexpected things happen with potentially exciting consequences.

FIGURE 1: Effect of Fluridone (-F & +F) on seed germination (per cent) under controlled conditions on agar for a range of weed species 42 days after imbibition



Fluridone treated annual ryegrass displaying signs of bleaching.

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What is fluridone and how does it break dormancy?

To say that Danica Goggin is understated about her excellent research is an understatement! It's our job to 'talk up' her research to ensure that the messages are heard. It was her

observations in the laboratory that led to the discovery that fluridone may have a place in Australian agriculture.

Danica was using fluridone to break the dormancy of annual ryegrass, as many seed researchers have done in the past. But Danica noticed that the ryegrass that germinated was bleached which led her to explore the herbicidal properties of fluridone.

What is Fluridone?

Fluridone is an aquatic herbicide used to kill weeds in potable lakes, ponds, dams and irrigation channels. Fluridone belongs to the PDS inhibitor group of herbicides, aka Group F herbicides in Australia. Other common examples of Group F herbicides are diflufenican (Brodal) and picolinafen. Fluridone is used by researchers to study seed dormancy.

Weed germination on agar

Under controlled conditions, germinating weed seeds on agar, Fluridone increased germination from a control level of 10 to 40 per cent to over 90 per cent for a range of weed species (Figure 1).

Annual ryegrass germination on various soil types

Fluridone is tightly bound to organic matter which would make it less available in soils with high organic matter. Fluridone had a greater stimulation of germination on river sand or sandy loam than potting mix (Figure 2).

Herbicidal activity

Fluridone killed nearly 100 per cent of ryegrass seedlings on low organic matter soils. Lower ryegrass seedling mortality was observed for Fluridone treated potting mix (Figure 3). Fluridone appears to have herbicidal activity on many grass species of weed as well as a few dicot species, but this is an anecdotal observation at this stage and is yet to be confirmed with detailed research.

Crop tolerance

Fluridone was not tolerated by wheat, canola, chickpea or common bean. But lupin and field pea tolerated Fluridone with 100 per cent seedling survival. Some patchy bleaching of the cotyledons of lupin and field pea was observed. These plants recovered from this phyto-toxicity and went on to grow normally.

FIGURE 2: Effect of Fluridone (-F & +F) on the cumulative germination (per cent) of annual ryegrass for fluridone treated potting mix (A), river sand (B) or sandy loam (C)

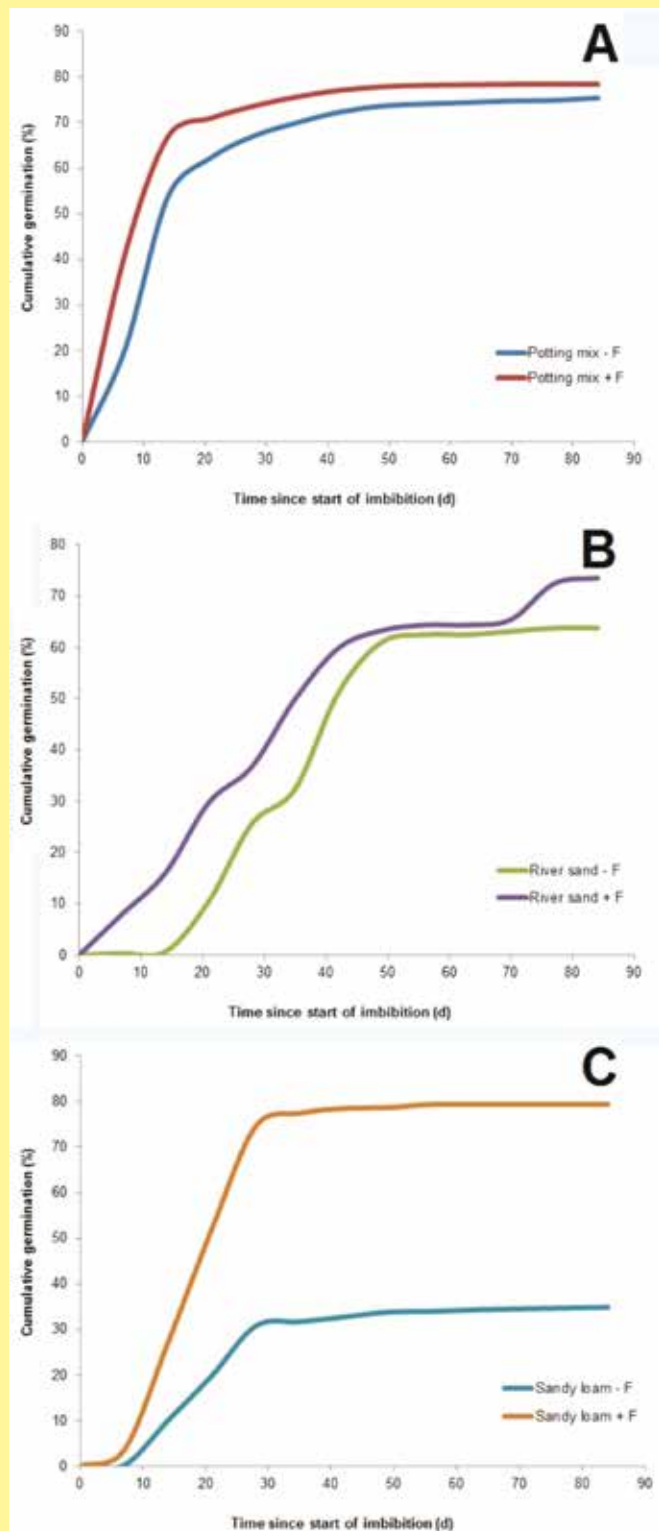
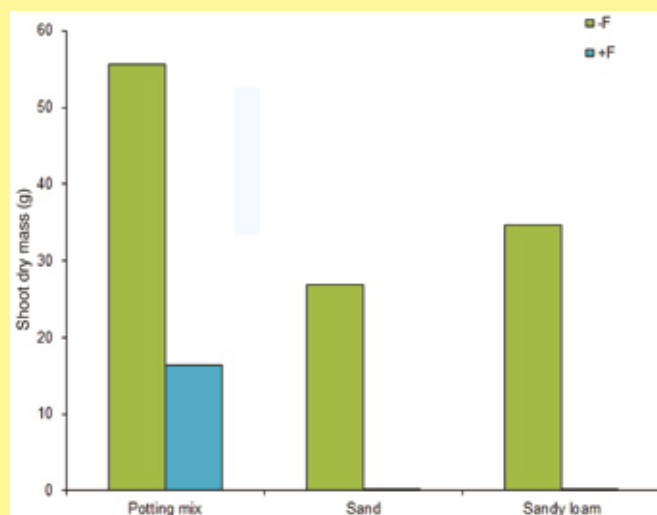


FIGURE 3: Herbicidal effect of Fluridone as demonstrated by annual ryegrass seedling biomass (g) for Fluridone (-F & +F) treated potting mix, River sand or sandy loam soil



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Field testing

The efficacy of Fluridone under field conditions could not be assessed owing to the lack of rainfall at the field trial site in April 2013.

Richard Devlin from Living Farm has conducted some pro-bono trial work this year with Fluridone. The results of this research are not yet available, but it is encouraging to hear that Richard observed the herbicidal effect of Fluridone in the field. More on this later in the year.

How does Fluridone break dormancy in weed seeds?

Seed dormancy has been studied by scientists for decades, yet there are still many aspects that are poorly understood. In fact, a recent scientific paper on the issue was titled *"Germination – still a mystery"*. Here is a summary of what we do understand, in very simple terms. Figures 5 and 6 provide some diagrammatic explanations.

FIGURE 4: Survival of crop plants sown into Fluridone treated sandy loam soil

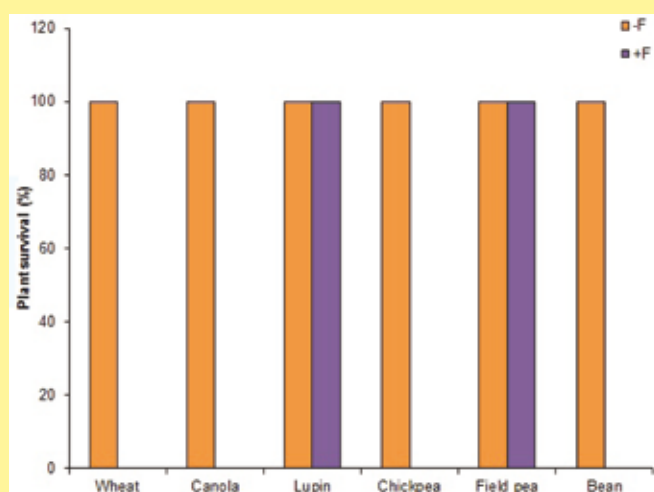
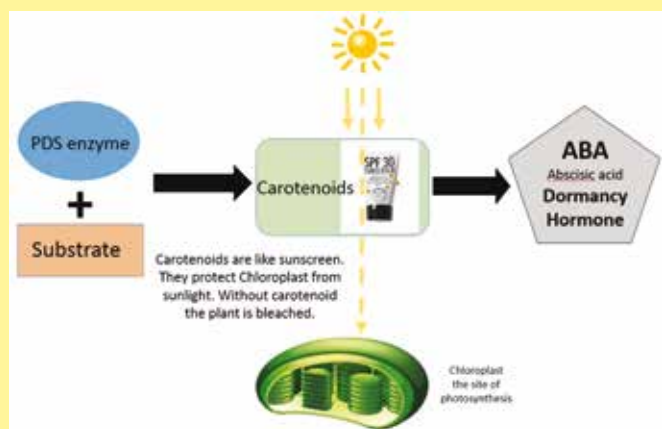


FIGURE 5: Diagram depicting the synthesis of carotenoids and their importance as 'sunscreen' to protect plant chloroplasts from being bleached by excess sunlight. ABA (Absciscic acid) is synthesized by the breaking of the carotenoid carbon chain into smaller pieces and one of these is oxidised into ABA



- Absciscic acid (ABA) is known as the dormancy hormone. Its role in dormancy is not fully understood. We know that the amount of ABA in a seed is definitely an important part of seed dormancy.
- ABA is produced as a product of carotenoid production.
- Carotenoids are like sunscreen. They protect the plant chlorophyll from the sun. Without sunscreen the plant gets burnt or bleached.
- Fluridone, and other PDS inhibiting herbicides, stop sunscreen (carotenoid) production. PDS is an important enzyme in carotenoid production. Group F herbicides inhibit the PDS enzyme. No PDS enzyme = no carotenoid production = bleached plants.
- No carotenoid production = no ABA production = no dormancy. When a seed first matures on the parent plant it has high ABA levels. This ABA level can slowly degrade through time until a point where the ABA levels are very low and the seed is no longer dormant.

When a seed in the soil first imbibes moisture, the seed fires up new ABA production. This ABA is produced and then degrades, then more ABA is produced and then degrades, and so on until the hormonal balance in the seed finally tips towards germination.

Adding Fluridone to the seed as it imbibes moisture for the first time stops ABA production in its tracks and allows the seed to germinate immediately.

Future possibilities

One of the current limitations of using Fluridone as a herbicide is how tightly it is bound to organic matter. It may be possible to adjust the formulation of Fluridone to make it more effective in soil.

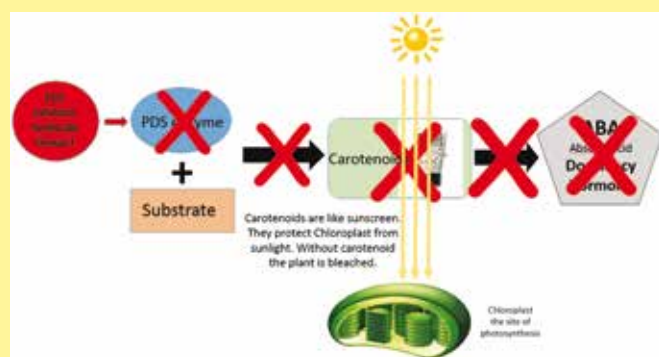
This early research showed that lupin and field pea demonstrated some tolerance to Fluridone. Future research could focus on finding more crops that are tolerant to Fluridone.

To sum up

It is very early days in the investigation of the use of Fluridone as a germination stimulant and herbicide, and it is possible that Fluridone will never be registered as a soil applied herbicide in its own right.

But sharing the results of pure research such as this may just be enough to inspire activity to develop something new for weed control. It is an understatement to say that we desperately need it! ■

FIGURE 6: Diagram showing how a PDS inhibiting herbicide such as Fluridone (Group F) stops carotenoid production leading to excess sunlight bleaching the chloroplast resulting in plant mortality. The inhibition of carotenoid production also stops ABA production which in turn removes seed dormancy.



Whacking weeds organically

■ By Jan Suszkiw, Agricultural Research Service – USDA

It can take real grit to control tenacious weeds. Although determination is an important attribute in farmers, Agricultural Research Service agronomist Frank Forcella is counting on grit of another kind in his approach to battling weeds.

In collaboration with South Dakota State University (SDSU) researchers, Frank has devised a tractor-mounted system that uses compressed air to shred small annual weeds, like common lambsquarters, with high-speed particles of grit made from dried corn cobs. Ongoing field trials may foretell of the system's potential to help organic growers tackle within-row infestations of weeds that have sprouted around the bases of corn, soybean, and other row crops.

Dubbed 'Propelled Abrasive Grit Management' (PAGMan), the system disperses 0.5 millimetre-sized grit particles in a cone-shaped pattern at the rate of about 300 kg per hectare, using 100 pounds per square inch of compressed air. An SDSU engineering team built the machine under a grant Frank was awarded from the USDA's National Institute of Food and Agriculture.

"For the first few weeks of the growing season, weeds are relatively small, and that's when we target them with the grit," says Frank, at the ARS North Central Soil Conservation Research Laboratory in Morris, Minnesota. The crop plants escape harm because they are taller than the weeds, and their apical



Ground corn grit that can be sprayed on weeds to shred their leaves. Each grit grain is about 0.5 mm in diameter. (Photo: USDA-ARS)

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Tractor-mounted system for spraying corn grit to shred the leaves of weeds growing between crop rows.

(Photo: Dean Peterson)



The tractor-mounted system uses compressed air to spray corn grit onto weeds growing between four rows of crops simultaneously. Nozzles work in pairs to control small weeds by shredding them. ARS scientists were able to control 80-90 per cent of weeds with two grit applications at two crop growth stages. (Photo: Dean Peterson)

meristems (growing points) are protected beneath the soil or by thick plant parts.

Current organic weed control methods include flaming (or scorching), soil tillage, and hand-pulling, among others. Still, weeds remain a chief agronomic concern requiring new approaches, says Frank.

This (northern hemisphere) summer will mark a second round of field tests of PAGMan on multiple rows of silage corn grown on four-hectare plots of certified organic land in Minnesota. "Last year, in corn with its full complement of weeds, we were able to get season-long weed-control levels of 80 to 90 per cent using two treatments of the abrasive grit – one at the first-leaf stage and the second at the three- or five-leaf stage of corn growth," Frank says. Corn yields compared favourably to those in hand-weeded control plots.

Initially, PAGMan consisted of a hand-held nozzle and compression hose hitched to a grit-filled tank on the back of an all-terrain vehicle. The tractor-mounted version, built by SDSU

professor Daniel Humburg and former graduate student Cory Lanoue, uses an air compressor to pump the grit through eight custom-made nozzles capable of covering a four-row area.

"We use corncob grit for our tests, but other agricultural residues could also be used," Frank says. Organic growers suggested using corn gluten meal as a way to fertilise crops and blast weeds simultaneously. "We tried corn gluten meal and found it just as effective. The amounts necessary for controlling weeds were similar to those used to supply nitrogen to organic crops."

Frank has published results from earlier, small-plot studies in *Weed Technology* and other peer-reviewed journals. Results from the 2013 field trials were presented this year at the Weed Science Society of America's annual meeting by SDSU graduate student Mauricio Erazo-Barradas and professor Sharon Clay.

Frank Forcella is with the USDA-ARS North Central Soil Conservation Research Laboratory, 803 Iowa Ave., Morris, MN 56267; Ph: +1 (320) 589-3411, ext. 127. ■

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John Deere – the man

■ By Ian M. Johnston

WE, who are in any way affiliated with the world of agriculture, accept and take for granted the constant unfolding of new evolutionary advancements, often breathtaking in their magnitude and potentiality.

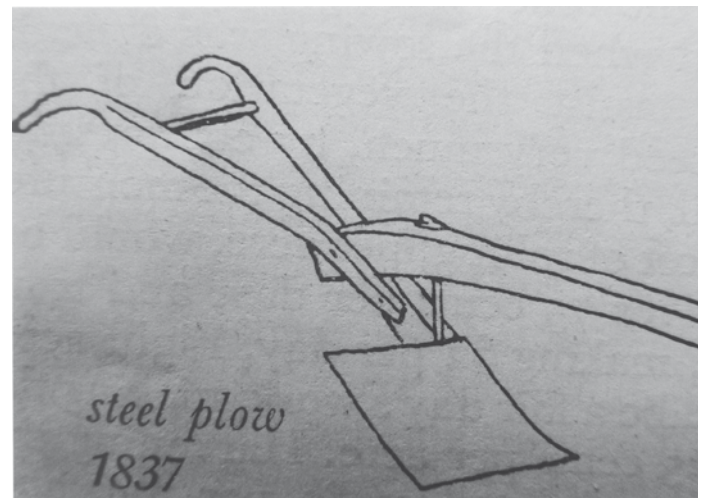
The astonishing versatility of genetically modified seeds, quantum leaps in the capabilities of herbicides and weedicides, new approaches to the necessity of protecting the integrity of our soil structure by the utilisation of no or low till practices, are all simply a part of today's global farming scene. None of which of course would be of relevance had there not also been a continuance of the evolution of farm mechanisation.

The genesis of the major advancement of agricultural implements and machinery occurred during the early decades of the nineteenth century, more or less paralleling the Industrial Revolution which was sweeping across Europe and North America.



John Deere.

Undoubtedly, one of the most prominent names associated with a breakthrough in design of farm equipment to emerge during this turbulent period, was that of a young American named John Deere.



The John Deere polished steel plough, circa 1837.

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A rail wagon loaded with John Deere ploughs, circa 1882.



An elderly John Deere proudly watches a Deere and Co horse drawn deep furrow plough at work.

The young John Deere

The rural community of Rutland in the leafy state of Vermont, was the birth place of John Deere, which took place on February 7, 1804. Later, his family moved to the nearby town of Middlebury where the young boy attended school, prior to serving a four year apprenticeship with a local blacksmith.

At age 21, he established himself in the business of manufacturing farm hand tools and quickly earned a reputation for the excellence of his polished lightweight shovels and pitch forks. But a series of bad seasons and depressed farm produce prices in Vermont, resulted in a downturn in trade. An exodus of disillusioned farmers packed up their wagons and headed for the 'promised lands Out West'. John Deere decided to follow in their tracks.

In 1836, with only a handful of tools and even less cash, he spent several weeks travelling by stage coach and river steamers until he finally arrived at his chosen destination, the small pioneer

settlement of Grand Detour, Illinois, located on the banks of the Rock River.

He discovered that streams of disillusioned farmers from the eastern states were pouring in to claim land in northern Illinois, attracted by the deep rich soils of the region. New homesteads had to be built and virgin land to be ploughed. John Deere's talents as a master blacksmith were in considerable demand. He quickly prospered and sent a letter to his wife and family who had remained in Vermont, stating the time was right for them to join him.

But there was a problem for the new colonist farmers, who were his customers. Unlike the sandy gritty country they had left behind in Vermont, the clay soil in Illinois, although rich in minerals, proved sticky and clung to the mouldboards and shares of their ploughs, which they had brought with them from the east.

During a ploughing operation, the horses or mules had to be halted every few steps, enabling the plough to be laboriously



The opening in 1900 of a new Deere and Co factory at Moline.



A portrait of John Deere demonstrating his plough.

scraped clean of the adhering clay. The cast iron or timber mouldboards which had worked well in the abrasive soils of Vermont, proved hopeless in Illinois!

The problem solved

John Deere realised there would be a fortune to be made if he could design and manufacture a plough capable of operating efficiently in sticky soil.

He believed that a highly polished scientifically shaped mouldboard could prove to be self cleaning as it progressed through the ground. The only polished high quality steel he could track down at Grand Detour was a cracked circular saw, imported

from England, that had been cast aside by a local timber mill. Accordingly, he painstakingly shaped a mouldboard using the material from the saw, into what he believed would be the answer to the problem.

One year following his arrival at Grand Detour, John Deere tested his plough in particularly claggy soil, at the Crandall farm on the outskirts of the settlement. To the amazement of the group of pessimistic farmers who had gathered to watch the proceedings – the plough performed brilliantly!

Overnight, John Deere was overwhelmed with orders from farmers, clamouring to purchase self polishing ploughs. Apart from the accompanying prosperity, the demand for his ploughs presented commercial complications. Grand Detour was hundreds of miles from major industrial centres. Purchasing steel proved to be a major logistical and frustrating problem. The limited available quantity of steel he could source restricted the number of ploughs he could produce and thus the potential for his business expansion.

In 1843, in desperation John Deere placed a major order with a British steel mill for a supply of polished steel rolled to his special requirements. After waiting patiently for nearly a year, eventually the steel arrived at Grand Detour from across the Atlantic. For a while this eased his production backlogs, but business was booming and the importance of obtaining a constant and regular supply of steel for his manufacturing facility became an imperative.

Expansion

In 1846 he consulted and placed an order with a foundry at Pittsburgh, Pennsylvania, which resulted in the production of the first slab of cast plough steel ever produced in North

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The present day Deere and Co corporate headquarters, Moline.

America. The steel was delivered by river boat to a modern new manufacturing facility which Deere had established at Moline, on the east bank of the Mississippi River.

Remarkably, it took only a decade from the time he demonstrated his first polished steel plough to achieve the staggering production figure of over one thousand ploughs a year! This despite the fact that he now faced serious competition from a number of emerging firms, including The Oliver Chilled Plow Works, Nichols and Shepard and others that were to become major players in the world of farm machinery.

Apart from the obvious popularity of the polished steel plough, possibly the real catalyst for John Deere's phenomenal success was his astute business acumen coupled to the engineering integrity that went into his rapidly expanding range of agricultural implements. He once famously stated "I will never put my name on a plough that does not have in it the best that is in me"!

An important milestone was achieved in 1868 when John Deere, at 64 years of age, incorporated his business under the name Deere and Company and appointed himself as President. He elected his son Charles as Vice President and Treasurer.

Charles Deere had been well taught by his father and his resultant commercial astuteness and perspicacity contributed significantly to the continuing development of the organisation. He established nation-wide distribution depots in order to serve the growing number of local independent agents.

John Deere died peacefully in 1886, just prior to his eighty second birthday, by which time Deere and Company was one of America's most recognised names. Under the presidency of Charles Deere the company continued to expand.

But a new challenge emerged in 1902, when the Chicago based giant conglomerate International Harvester Corporation was created by the merger of a number of Deere and Company's competitors. In order to reinforce its own commercial strength and create a bolster against the threat emanating from International Harvester, Charles Deere deployed similar tactics and acquired various firms, some of which were suppliers of raw materials and component parts, whilst others were established John Deere dealer outlets.

The constant stress and tribulations took their toll on the health of Charles Deere, necessitating the eventual hand over of the presidency to his son-in-law and heir William Butterworth. He did so in the firm knowledge that Butterworth was well conversant with the high principals of rectitude and probity established by his late grandfather, John Deere.

Under Butterworth's control, Deere and Company continued to grow, expanding into tractors and which today embraces

the entire gambit of agricultural and industrial machinery. It has become one of the great corporate manufacturing conglomerates with manufacturing facilities strategically placed around the world.

A century later

It is interesting to contemplate the fact that nearly two centuries have passed since the young John Deere first established his blacksmith's shop. His passion for rectitude and his philosophy of integrity were the fundamental drivers of his extraordinary success in business.

Deere and Company is the only long established corporate farm machinery organisation on the planet to have been able to withstand the challenges of takeovers and mergers. On the contrary, it has been the one to successfully acquire competitive firms. Examples include the acquisitions of Heinrich Lanz A.G. in Germany and Chamberlain Industries in Australia.

John Deere – the man – would have approved!

Compiled from archival material which was generously made available to me during a visit to the Deere and Co. archives at Moline, where I was welcomed by senior staff and offered every assistance with information for my journalistic work. I wish to acknowledge my appreciation for their kind co-operation and permission to reproduce the graphics in this article. ■

POSTSCRIPT...

As a 15 year old lad, working on a farm high on the hills near the village of Auchtermuchty in Scotland's central Fife, I recall being schooled in the skill of working a single furrow mouldboard plough pulled by a pair of massive Clydesdales.

The old Highlander teaching me emphasised the necessity of always protecting the polished curved face of the plough by coating it with rendered pig's fat, at the end of each ploughing job.

The plough in question was at least a quarter of a century old and yet the polished surface gleamed!

By an amazing coincidence, the plough bore a plate stating that it had been manufactured by James Mitchell, blacksmith of Gladsmuir, East Lothian. James Mitchell was my great grandfather!

IAN'S MYSTERY TRACTOR QUIZ

Question: What is the make?

Clue: Well heeled sporting gentlemen drive them!

Degree of difficulty: Pretty darned hard!

Answer: See page 48.





NORTHERN FOCUS

COVERING NORTHERN NSW AND QUEENSLAND

THE RESEARCH VIEW

Breeding new wheats with drought tolerant genes

AT A GLANCE...

- A gene that controls the way plants respond to drought could lead to new drought-tolerant wheats.
- Researchers at the ARC Centre of Plant Energy Biology, Australian National University, discovered a protein that controls the amount of a signal between chloroplast and nucleus of a plant that regulates its response to drought.
- Researchers are screening wheat populations to find plants that lack copies of the crucial gene, which should mean they make more of the signal and survive longer and grow better in times of drought.

THE discovery of a gene that controls the way plants respond to drought could help lead researchers to the 'holy grail' for many farmers – a new drought-tolerant, high-performing line of wheat.

Researchers at the ARC Centre of Plant Energy Biology, Australian National University, made the significant discovery several years ago of a protein that controls the amount of a signal between chloroplast and nucleus of a plant that regulates its response to drought.

They are now using that knowledge to screen wheat populations to find plants that lack copies of the crucial gene, which should mean they make more of the signal and survive longer and grow better in times of drought.

Leading the research at the ARC Centre of Plant Energy Biology is Professor Barry Pogson, who said the model plant used in the initial research survived 50 per cent longer than a normal plant when no water was added.

"During drought these plants continue to do photosynthesis and continue to grow whereas normal plants just stop growing and ultimately die," Barry said.

"Nothing grows when there is no water at all but if the plants can survive better in a short to medium-term drought then farmers could get better, more reliable yield."

Worldwide repercussions

Barry said initial work was done with a relative of canola, but preliminary research suggested the same protein was present in wheat, which meant the research could have significant repercussions for Australian farmers and global food supply.

"It could mean improved productivity in dry seasons and regions. For example, if there was a delay in spring rains, varieties

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with drought tolerance would still maintain biomass to ensure good grain filling when the rains arrive.”

Long-term collaborator at CSIRO, Dr Gonzalo Estavillo, said the gene regulating the plants’ drought response was called SAL1 and any plants lacking one or more functional copies of the gene should be more drought-tolerant.

Arun Yadav, who works with Barry, discovered that wheat plants have up to seven copies of the gene, and each may have slightly different functions related to drought tolerance and the production of the signal in different parts of the plant, like roots, seeds or leaves.

The GRDC recently agreed to support four years of research, to find wheat lines that lack at least one of the SAL1 genes and have more of the signal. The goal is to find wheat lines that are more drought tolerant, but without affecting agronomic performance.

Both GRDC and CSIRO have developed non-GM wheat populations that lack different genes and Barry’s group is using them for the search. This demonstrates the importance of different research organisations being able to work together and the need to maintain a critical mass of research capacity across the country.

He said making use of existing populations and avoiding genetically modified populations would streamline the process and allow the product to reach the market much sooner.

Barry said it was important that the wheat retained other traits that farmers required, such as high yield and disease resistance.

Early indications are promising

Arun said they had already found wheat varieties that lacked two of the seven genes and early indications of drought resistance abilities were promising.

“The key is to find the one that works in the right tissue at the right stage of development or during drought in particular, and then we might only need to find reduced activity in one gene,” he said.

“The work is being undertaken in a high-performing line of wheat although we don’t yet know if the wheat plants lacking the two SAL1 genes are as good as the existing lines for yield, which is the vital factor for growers.”

Barry said the goal for farmers was to maximise yield in good years, maintain it in the moderate years, and minimise losses in the bad years.

Better for profitability

“Yield stability refers to getting good yield in most years and Australia does worse than most other countries because of extremes of climate and poor soils,” Barry said. “Projects like this one working towards getting more stable yield are better for profitability.”

Barry said as Australia’s climate becomes more variable the need for wheat that could tolerate mid-season dry spells would continue to grow.

“The big pressure on agriculture is we have to increase food outputs by up to 70 per cent by 2050 to meet the growing needs of the world’s population.

“Australia is a major exporter of wheat, and wheat is second only to rice as a food source for the world’s population, so the sustainable production of wheat in a variable climate is critical.

“From a research and development perspective it is very promising to go forward from model plants into crops. It is still too early to know if we will achieve the desired goal, but we are determined to try and succeed.” ■

THE COMMERCIAL VIEW

DROUGHT TOLERANCE GENES TO PROVIDE SPRING PROTECTION

The prospect of wheat varieties carrying drought tolerance genes is exciting news for northern NSW grain grower Geoff O’Neill, of ‘Llano’, Bellata.

The ARC Centre of Plant Energy Biology at Australian National University has identified genes which influence how plants cope under moisture stress.

The model plants used by researchers in early trials have survived up to 50 per cent longer than a normal plant when no water was added.

They are now using that knowledge to screen wheat populations to find plants that lack copies of the crucial gene, which should mean they make more of the signal and survive longer and grow better in times of drought.

Geoff said moisture stress was an issue at some point in every growing season, and could be particularly damaging during spring when crops were flowering.

“It’s great to see this type of research from the GRDC – the whole basis of what we do is to turn moisture into grain so anything that helps our crops to survive until more water is available will be a great benefit to us,” Geoff said.

Geoff farms 6000 hectares of mostly dryland, black soil country, with a mixture of summer grain and cotton, and winter cereals and legumes.

The property receives an annual average rainfall of 590 mm, and although it falls predominantly in summer, the most useful rain arrives during the winter months.

“Our soils store a lot of moisture, but in-crop rain is always much better,” he said.

“In years when the rainfall outlook is marginal, or our subsoil moisture is not ideal, having varieties with the ability to tolerate moisture stress will give us a lot more confidence to go ahead and plant.”



Bellata farmer Geoff O’Neill says crop moisture is an issue at some point in every grain season.

Genetic mapping of rust-resistance genes in sunflower

■ By Sharon Durham, Agricultural Research Service – USDA

RUST is a serious fungal disease of sunflowers around the world. The disease can significantly reduce sunflower yields and has been increasing in severity in many of the world's major production regions.

Sunflower seeds are predominantly grown as an oilseed crop, but some varieties are specifically grown as "confection" varieties, meaning their kernels are for eating – either raw or roasted.

An economic and environmentally friendly method to control rust is to use resistant cultivars and hybrids. Developing genetically resistant hybrids is the preferred approach for disease management, but few widely effective resistance sources to sunflower rust have been identified.

Agricultural Research Service molecular geneticist Lili Qi, in the Sunflower and Plant Biology Research Unit in Fargo, North Dakota, has screened for resistance genes and genetic markers in sunflower genomes. Her collaborators in the study, which was published in *Theoretical and Applied Genetics*, included Thomas Gulya and Brent Hulke, in the sunflower research unit, and Li Gong and Samuel Markell, with North Dakota State University.

First, Lili and her colleagues identified DNA markers to determine the possible locations of resistance genes on sunflower chromosome 13. Two resistance genes have been mapped by the group – R13a in the confection sunflower line called 'HA-R6' and R13b in the oilseed line called 'RHA 397'.

The USDA inbred line HA-R6 is one of the few confection sunflower lines resistant to rust.

"The genes R13a and R13b are highly effective against all rust races tested so far," says Lili. "The newly developed markers will help in breeding efforts to confer rust resistance to the sunflower genomes and accelerate the development of rust-resistant sunflower hybrids in both confection and oilseed sunflowers."

These genetic findings couldn't come at a better time. In an annual field survey conducted by the North Dakota State University Cooperative Extension Service and the US National Sunflower Association, sunflower rust was found in 60 to 77 per cent of surveyed fields. Kernels infected by rust can be damaged and discoloured and are therefore unlikely to meet grading standards established by the industry for confection sunflower seeds.

"Yield losses to the disease can occur in the wide range of environments and climatic conditions where sunflowers are grown – from the hot and dry climates of the US Central Great Plains to the cooler and wetter climates of North and South Dakota," says Thomas.

"These lines, HA-R6 and RHA 397, should be very useful in breeding commercial sunflower hybrids with high-level, durable resistance to rust," says Lili.

Lili Qi is in the USDA-ARS Sunflower and Plant Biology Research Unit, Red River Valley Agricultural Research Center, 1307 18th St. N., Fargo, ND 58102-2765; Ph: +1 (701) 239-1351.



Rust response in three seedling sunflower plants 12 days after inoculation with the most virulent rust race identified so far in the United States. HA 89 (an oil-type sunflower) and CONFSCLB1 (a confection sunflower) are highly susceptible, showing typical symptoms of rust in the infected leaves, whereas HA-R6 (also a confection sunflower) is highly resistant and shows no symptoms. (Photo: Lili Qi)

Fertiliser placement and changing farm practices

■ By Dr Mike Bell, QAAFI



DECISIONS about phosphorus (P) fertiliser use on pulses like chickpeas and mungbeans are shrouded in uncertainty, partly because so little research has been done to determine the extent of P responses in these species.

A common misconception has been that these pulses show little response to P fertiliser, mainly because neither species has an obligate P requirement in early growth to set final grain number, unlike grains such as wheat, barley and sorghum. But recent experience suggests both species do respond to P and, in some cases, the response is very strong.

Requirements for P mirror crop growth, with demand greatest when growth rates are high. Both chickpeas and mungbeans require some starter P (in low P soils) to help the crop root system establish and to grow vigorously as it uses moisture and nutrients in the subsoil. Deficiency can occur if there are insufficient nutrients available deeper in the profile.

Fertiliser placed to meet growth demands

Perhaps the greatest response to P and K (potassium) in our environments occurs when these nutrients are either already



present or placed as fertiliser in the subsoil (10–30 cm layer). These deeper nutrients are well placed to meet the demands for growth, as they are in moist soil for longer and are in profile layers where there are lots of crop roots.

Deeper placement is particularly important for chickpeas, which are often planted below the top 10 cm layer, which typically has the highest immobile nutrient concentrations. As the coarse taproot system develops, only P from deeper in the profile can be accessed.

Changes in farming practices over recent decades have seen the nutrient profile of agricultural soils alter, particularly for immobile nutrients like P and K. While subsoil reserves are depleted, topsoil concentrations can be retained or even increase due to inputs from crop residue and surface applied fertiliser.

These shallow nutrient stores are not available to plants when topsoils are dry, and we no longer till to redistribute those nutrients into the subsoil. Therefore, nutrients removed from subsoils require replacement, and the idea of deep placement of fertiliser bands has been investigated at a number of trial sites since 2006–07. While not specifically targeting pulse crops, chickpeas and mungbeans have featured in the crop rotations.

Deep placement trials

In each trial the reference treatments consisted of normal practice (eg. starter fertiliser at the normal farm rate), a nil treatment (no P or K applied, but with deep tillage), a starter



Potassium deficiency in young mungbeans.



Chickpeas growing at Gindie in 2013 with (top) and without (bottom) P and K applied in deep bands.

P treatment and a starter P treatment with either extra P (or K) applied deep (15–20 cm) during the preceding fallow. The nil and starter P treatments provided benchmarks for the effects of P, and also the effects of soil disturbance when compared to the farmer normal practice.

Deep placement of phosphorus, typically at a rate of 40 kg P per hectare, was applied as TSP or MAP at depths of 15–20 cm (with extra N applied to compensate for the N in MAP), with bands 50–100 cm apart. Deep placement of potassium was also in bands and at the same depth and spacings, using a typical application rate of 100 kg K per hectare applied as muriate of potash. In sites where both P and K were low, trials looked at adding each nutrient alone or as a combination of P and K to simultaneously overcome both constraints.

Rates were deliberately high to ensure residual effects could be followed in subsequent crop years.

While the number of pulse trials is small, especially from the 2013 winter due to a combination of both dry conditions and frost, there have been some consistent trends emerging.

What we are finding

Chickpeas seem to be fairly consistently responding to P placed deep in the soil profile. Responses were significant in three of the four trial sites, with a trend for an increase in the fourth site. Some of the higher yielding crops accumulated 20–30 kg P per hectare in the crop biomass, with up to 40 per cent of that coming from the applied P. Yield responses typically averaged an increase of 20 per cent.

Mungbeans crops also demonstrated a trend for benefits from



Deep placement of fertiliser is a practical option that does not alter surface cover or produce a cloddy surface.

deep P at all sites. But while relative benefits ranged from 10 per cent to an impressive 60 per cent yield increase, depending on soil P status, the benefits were only statistically significant in one of the three trials. There also seemed to be greater responses to starter P than in chickpeas, although more work is needed to confirm this.

At a number of sites there were interactions between P and K (see the case studies below). At the Capella site the primary limitation was P (generating a 20 per cent yield increase), with a trend for a small additive effect of K. But at Gindie the primary limitation was K (generating a 27 per cent yield increase), with a strong additive effect of P after the K demand was met, making a total of 51 per cent yield increase.

Similar P and K effects were seen in a mungbean trial near Warwick, but while both P and K effects were significant there was no evidence of additivity. This can occur where the better root development that occurs when P deficiency is corrected allows the crop to then scavenge more effectively for K.

This is the equivalent of squeezing a little more blood from the stone, as it does nothing to replenish soil K reserves!

The implications of these findings from a farming systems perspective are significant. Many farmers are concerned over the suggested return to deep tillage – even if only at infrequent intervals. But the management of immobile nutrients may require the use of such tillage if we are to replenish nutrients exported from farms across the region.

The recommended frequency of this management strategy will be considered as the research project continues to collect data about the residual effect of fertiliser placed at depth.

Early results indicate that the benefits of deep placement of fertiliser may be reasonably long-lasting and so the frequency required may be tied more to the application rate than any other factor.

Case studies – CQ fertiliser deep placement trials

Two trials were conducted on sites near Capella and Gindie in Central Queensland, with support from the International Plant Nutrition Institute (IPNI) and Canpotex. Soil tests (Table 1) indicated that the soils at both sites were depleted in P, K and S (sulphur).

In winter 2011, treatments of these nutrients, alone and in combination, were banded 50 cm apart at depth during a fallow at both sites. Crops of chickpea (2012) followed by wheat (2013) at Capella and sorghum (2011–12) followed by chickpea (2013) at Gindie have so far been monitored for yield responses.

At Capella, deep placement of P gave rise to a 20 per cent increase in yield above the control (deep tillage only) – an additional 500 kg per hectare of grain. Along with this main response there was also a slight trend for an additional benefit of K once P was adequate, such that the combined effects of deep tillage and (P + K) fertiliser yielded 900 kg grain per hectare more than the farmer reference.

Effects in the following wheat crop were limited by a lack of water (there was no in-crop rain in 2013) that restricted the development of secondary roots and tillers (a key part of wheat P responses), but trends for higher yields with P and K (13 per cent increase) were still evident.

The additional crop production (2012 chickpea at \$550 per tonne and 2013 wheat at \$275) was calculated to be worth \$310 per hectare for P only, or \$380 per hectare for P+K.

Compared to commercial practice (no deep tillage) in 2012, the combined effects of deep tillage and P lifted the combined benefit to \$600 per hectare after two crop seasons.

At Gindie the sorghum crop only responded to P (again a 20 per cent yield increase), but the chickpea crop responded to the residual of the applications of both P and K, and there was a strong additive effect of the two fertilisers that delivered a 51 per cent yield increase. The primary limitation in this season seemed to be K (27 per cent response), and only once K was supplied could the additional response to P be observed.

These yield increases represented additional grain production

of 340 and 530 kg per hectare respectively, with the combined value of additional crop production (assessed as 2012 sorghum at \$200 per tonne; 2013 chickpea at \$375) worth \$160 per hectare for P only, or \$320 per hectare for P+K.

Interestingly, the dry seasonal conditions in 2013 seemed to enhance the response to residual deep P and K in chickpea (where development of secondary roots and tillers is not a key driver of extra yield) at Gindie, versus the opposite effect in wheat at Capella.

The question remains about how long the residual benefit of deep placement of fertiliser will continue.

Deeper soil tests needed

Minimum tillage and long-term export of nutrients have resulted in depletion of P, K and S reserves at depth across the northern region. Research to date suggests that analysis of the 10–30 cm soil layer, along with the traditional top 10 cm layer, is critical for assessing P and K status of soils. Sulphur is more mobile in the soil and so testing as deep as 60 cm is needed to assess the status of this nutrient.

There is currently no information on the critical soil concentrations of these nutrients in the subsoil for any crop. Research is underway to fill these gaps in our knowledge through trials across the region, from the Central Highlands in Queensland through to the southern Liverpool Plains in New South Wales, with additional sites in the western areas of southern Queensland and central and northern NSW.

The focus of this research is to determine the critical soil concentrations required for yield responses in sorghum, wheat, mungbean and chickpea to applied P, K and S.

To read additional relevant articles go to Pulse Update Annual at www.pulseaus.com.au

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FIGURE 1: Chickpea at Capella 2012 (first crop after treatments)

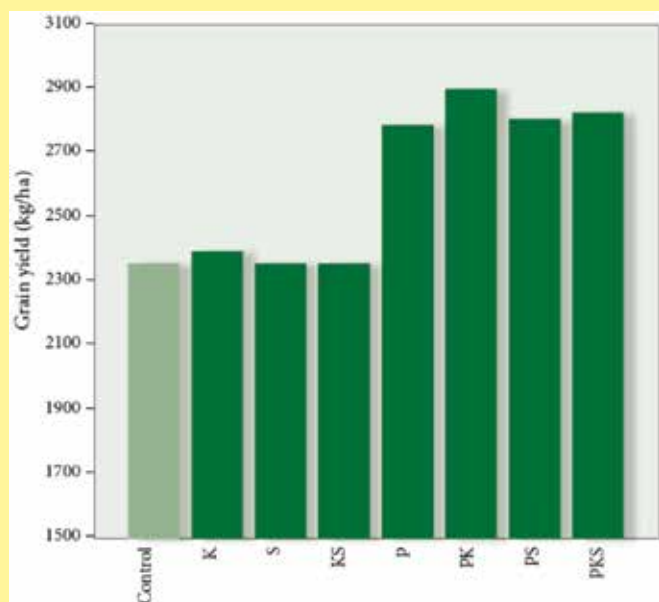


FIGURE 2: Chickpea at Gindie 2013 (second crop after treatments)

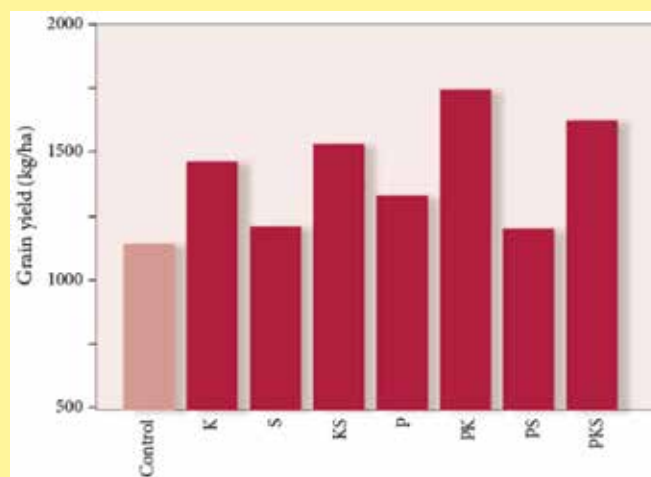


TABLE 1: Soil test data from case study sites

Site	Depth (cm)	pH	Colwell P	BSES P	SO ₄ -S	Exch K	CEC	DTPA Zn	Org C%
Gindie	0–10	7.2	13	10	3	0.17	35.3	0.2	0.6
	10–30	7.8	<5	5	2	0.07	38.4	0.1	0.5
Capella	0–10	8.1	10	14	3	0.46	73.7	0.25	0.7
	10–30	8.3	<5	9	2	0.16	74.6	0.1	0.65

Green peach aphid insecticide resistance causes concern

NORTHERN region grain growers are being encouraged to put in place insecticide resistance management strategies compatible with the long-term management of green peach aphid (GPA).

Studies funded by the Grains Research and Development Corporation (GRDC) have found that the extent of insecticide resistance in GPA populations across Australia has escalated.

With widespread resistance to synthetic pyrethroids, carbamates and organophosphates existing in Australia's mainland cropping regions, insect pest management experts say rotating chemical groups and taking advantage of biological control are essential to extend the useful life of available chemistries.

They say heavy reliance on insecticides to manage aphid populations places strong selection pressure on the insect to develop resistance, leaving growers with limited future control options.

Be wary of GPA build-up

GPA is not considered a major pest of canola or pulse crops in the northern region but is known to be present in these crops at sub-threshold levels, according to Department of Agriculture, Fisheries and Forestry (DAFF) Principal Entomologist Dr Melina Miles.

"Consequently, it is important that growers are aware of the risk of increasing the prominence of this pest through the use of insecticides to which it is resistant," Melina said.

GPA is a major pest of several horticultural commodities and can transmit more than 100 plant viruses such as beet western yellows virus (BWYV) and cucumber mosaic virus (CMV). A combination of BWYV and aphid damage early in the life of a canola crop can cause yield losses of up to 50 per cent.

Research led by science-based company Cesar has been investigating GPA insecticide resistance in cropping regions over the past two years and the findings and implications for growers are outlined in a new GRDC Fact Sheet, *Resistance Management for Green Peach Aphid*.

Dr Paul Umina, of Cesar, says resistance to synthetic pyrethroid insecticides has become significantly more common over the past 10 years. Organophosphate resistance has also been identified in many field populations across all states.

"More alarming was the discovery that more than half of all populations surveyed across Australia were resistant to the carbamate, pirimicarb," Paul said.

"At the population level, we have identified resistance to all three chemical groups – synthetic pyrethroids, carbamates and organophosphates. GPA resistance to insecticides has been known overseas for some time, but the widespread resistance to all three chemistries is something that has only been observed recently in Australia."

Higher than expected

Paul said the levels of resistance identified were far greater than what was anticipated.

The confirmation of widespread resistance to pirimicarb was particularly concerning for pulse and oilseed growers as this chemical is widely used because it is aphid-specific and less harmful to other invertebrates, and therefore compatible with an integrated pest management (IPM) approach.



Studies funded by the GRDC have found that the extent of insecticide resistance in GPA populations across Australia has escalated. (Photo: Andrew Weeks)

Within Australia, GPA primarily reproduce asexually to produce clones of themselves and recent studies have shown that individual clones contain resistance to multiple chemical groups. This unfortunately means that controlling these populations will be difficult with chemicals, even if rotating between different chemical groups.

Western Australian-based CSIRO research scientist Dr Owain Edwards says it is likely that GPA has developed resistance to more insecticides than any other insect species, not only in Australia but throughout the world.

Owain said that since he was involved in a GRDC-funded national survey of GPA in the mid-2000s, the increase in insecticide resistance in Australian populations had grown at a significant rate.

"With the resistance profile we now have, controlling GPA in years of high infestation can be difficult," Owain said.

"Problem years for GPA tend to be associated with an abundant 'green bridge' over summer, so it is important to eliminate weeds and volunteer crops growing during the period between harvest and sowing."

Growers are advised to implement GPA insecticide resistance management strategies including:

- Avoiding the use of cheap, broad-spectrum 'insurance' sprays;
- Applying insecticides only after correctly identifying pest species and monitoring to determine the likelihood of crop loss;
- Rotating insecticides from different chemical groups;
- Considering the selection pressure on GPA of using synthetic pyrethroids, carbamates and organophosphates to control other pests early season; and,
- Incorporating non-chemical control methods and encouraging beneficial insect activity by using 'softer' chemicals and biopesticides.

The Fact Sheet can be viewed and downloaded via www.grdc.com.au/GRDC-FS-GreenPeachAphid

New leader for Ag Institute Australia

TOOWOOMBA-BASED consultant and farmer David Hamilton is the new leader of Ag Institute Australia, the body which represents agriculture professionals nation-wide.

David was elected National Chairman at a Board meeting in Brisbane following the Institute annual meeting.

He succeeds Victorian consultant Mike Stephens who held office for three years and is remaining on the national board.

David set up his own consultancy after a 38 year career with the Qld Department of Primary Industries. He joined the department as an extension agronomist in 1974 and rose to General Manager Plant Science.

His consultancy has a strong focus on managing land and water resources and he holds a number of external positions including Chairman of the Basin Sustainability Alliance.

He is an agricultural science graduate from the University of Queensland and completed his Masters in the United States at Texas A and M University.

David's consultancy work is grounded in practical farming experience on a cotton and grain growing property near Dalby.



David Hamilton.

"Australian agriculture is underpinned by professional science and I believe it is important for the Institute to communicate how crucial our role is," David said.

"It's also important that we focus on developing our skills and setting and maintaining standards for consultants, advisers and all professionals in agriculture."

He said the Institute was developing a strategy to improve its engagement with agricultural students and young science graduates who were the future of the profession.

"We also intend to continue building affiliations with like-minded groups serving the rural sector," David said.

The Institute also has a new Deputy Chairman – Andrew Bishop who is the Tasmanian Government's Chief Plant Health Manager.

Chaseley Ross is the company secretary. She conducts a national consultancy business from her base on the Gold Coast.

Don Burnside from Western Australia was elected Treasurer to succeed the retiring Robert Patterson, an ag consultant from Cootamundra in NSW.

Don has had a 40 year career in natural resource management with interests in rangeland management and ecology, dryland agricultural production and regional economic and community development.

Richard Routley has also retired from the Ag Institute board. He is a Principal Agronomist with the Qld Department of Primary Industries in Toowoomba.

For more details, contact David Hamilton on 0429 466351. ■

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THE RESEARCH VIEW

Growers need to be on the ball for best sclerotinia management

WESTERN Australian research has shown that applying a single fungicide spray is often effective in reducing canola yield losses from sclerotinia stem rot (*Sclerotinia sclerotiorum*) when the crop is at the 15 to 30 per cent flowering stage.

But if the sclerotinia pathogen begins releasing spores late in the season, which occurred in WA in 2013, fungicide application has been shown to be effective at the 50 per cent flowering stage.

"The trial results from recent years suggest that the timing of fungicide application should coincide with the onset of spore release but also take into account whether seasonal conditions are likely to be conducive for the development of the disease," Department of Agriculture and Food (DAFWA) researcher Ravjit Khangura said.



DAFWA researcher Ravjit Khangura says research shows that all registered fungicides are effective and that controlling sclerotinia consistently increases crop yields in areas with high disease pressure.

Consultants' Corner

Consultants' Corner is an initiative by *Australian Grain* highlighting current GRDC-funded research with a particular focus on the commercial implications of adopting cutting-edge research.

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Sclerotinia spore-producing bodies within a canola stem.

The research led by Ravjit, and supported by the Grains Research and Development Corporation (GRDC), shows all registered fungicides are effective and that controlling sclerotinia consistently increases crop yields in areas with high disease pressure.

Ideal spraying window is short

Ravjit encouraged canola growers to have foliar fungicides on-hand and ready to apply at the optimum flowering stage, as the ideal spraying window could be as short as a few days.

She said tightening canola rotations had increased the incidence and severity of diseases such as sclerotinia, posing agronomic challenges to growers.

"This is especially the case in high and medium rainfall zones, where foliar fungicides are becoming a routine part of the canola agronomy package," Ravjit said.

"Yield reductions from this disease can be as high as 30 to 40 per cent – or up to 0.5 to 1 tonne per hectare – in heavily infested crops in high rainfall years.

"Sclerotinia survives in the soil for many years. Spores released from the fungal fruiting bodies initially infect canola petals, which subsequently drop into the canopy and can lead to leaf and stem lesions which cause lodging and plant loss.

"The main management strategy for sclerotinia is to reduce



Stem lodging/breakage due to sclerotinia infection.

the frequency of host species, in particular broad-leaved crops such as canola, lupins, chickpeas and lentils.

"It is recommended that growers avoid planting canola on paddocks that have had high sclerotinia levels at any time during the previous three years.

"Foliar fungicides (which cost about \$30 to \$50 per hectare per application) are the only means for in-crop management of sclerotinia.

"Registered fungicides for managing sclerotinia in canola are Prosaro and products which contain Iprodione (eg. Rovral Liquid) and Procymidone (eg. Sumisclx and Fortress)."

Why sclerotinia was so bad in 2013?

Ravjit says sclerotinia was particularly damaging in WA in 2013. "The disease severely damaged canola crops across high and medium rainfall zones of WA, causing an estimated loss of more than \$59 million to the state's canola industry."

Ravjit said this was due to five main factors:

- Substantial canola plantings over the past few years resulted in a build-up of sclerotinia inoculum;
- Tight canola rotations have also increased inoculum levels;

- Varietal susceptibility coupled with an extended flowering period;
- Flowering coinciding with spore release from the sclerotinia pathogen; and,
- Environmental conditions which favoured flower infection and subsequent stem infections.

2013 trials in WA

Research led by Ravjit in 2013 built on trials conducted in previous years investigating the optimum time to apply foliar fungicides, to help growers cost-effectively manage sclerotinia.

The 2013 field trial was conducted at East Chapman in WA's Northern Agricultural Region.

The canola variety Cobbler was sown in a paddock with a history of high levels of sclerotinia.

Prosaro was applied either as a single application or as two applications at various bloom stages.

Sclerotinia assessments were made two weeks before harvest and all plots were harvested for canola grain yield.

Results

"In the 2013 trial, fungicide applied late in the season at or after 50 per cent bloom significantly reduced the incidence of sclerotinia and significantly improved the canola grain yield compared with the untreated plots," Ravjit said.

"This well timed single spray resulted in a yield increase of 29 per cent and the best gross margin of \$102 per hectare.

"Fungicide applied very early at the six to seven leaf stage (before the crop flowered) did not significantly increase yield, and resulted in a negative gross margin. The measured yield loss from sclerotinia in this trial was 26 per cent."

Ravjit said the success of the fungicide applications at or after

the 50 per cent bloom stage was possibly due to the later onset of sclerotinia spore release in 2013.

"Trial results from previous, more 'typical' seasons, when sclerotinia occurred earlier in the year, showed that fungicide application was most effective at the 15 to 30 per cent flowering stage," she said.

"In some districts with a history of high levels of sclerotinia and high crop yield potential, two fungicide applications may be cost effective."

Ravjit said late maturing varieties showed the highest levels of sclerotinia in the 2013 trial at East Chapman because the stages of flowering in these varieties coincided with the commencement of spore release.

"But in a normal season when there is an earlier onset of disease, late maturing varieties may escape serious infection," she said.

Further research

With support from the GRDC, DAFWA is continuing research to refine the use of Prosaro to control sclerotinia.

Using epidemiological data collected over the past four years, the department is also developing a sclerotinia forecasting system which will help growers make well informed decisions about the use of fungicides, and reduce the requirement for fungicides in seasons unfavourable to sclerotinia like 2010 and 2012.

"In addition, we are working on developing other tools to assist growers in making decisions regarding fungicide sprays and to optimise crop profitability," Ravjit said.

Management practices to reduce risk

Foliar fungicides are effective against sclerotinia, but cost about \$30–50 per hectare per application. Registered fungicides



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for managing sclerotinia in canola are Prosaro and products containing Iprodione (eg. Rovral Liquid) and Procymidone (eg. Sumislex, Fortress).

Ravjit recommends the following management practices to reduce the risk of canola crop damage from sclerotinia:

- Reduce the frequency of host crops – including canola, lupins, chickpeas and lentils;
- Use recommended canola varieties, sowing dates and seeding rates for your district, as the flowering time and length of the flowering period will vary in response to seasonal conditions, and bulkier canopies can favour disease infection;
- Use clean seed free of sclerotes;
- Base the use of fungicides on:
 - Disease risk
 - Conducive conditions for disease development (including rainfall and crop biomass levels)
 - Maturity of the variety
 - Crop yield potential
 - Canola prices;
- Research has found that in 'typical' seasons, a single fungicide application at 15–30 per cent flowering is generally effective in reducing yield losses from sclerotinia by preventing main stem infections. In some districts with a history of high levels of stem rot and high crop yield potential, a second application may be cost effective.

More information on sclerotinia management is available from the following resources:

GRDC Fact Sheet: Managing Sclerotinia Stem Rot in Canola:
www.grdc.com.au/GRDC-FS-Sclerotinia

GRDC Back Pocket Guide: Managing Blackleg and Sclerotinia in Canola:
www.grdc.com.au/GRDC-BPG-CanolaDiseases

WA Farmnote 546: Managing the risk of Sclerotinia stem rot in canola:
<https://www.agric.wa.gov.au/canola/sclerotinia-stem-rot-canola>

LABEL CHANGE FOR GRASS CONTROL IN CANOLA

Canola growers are advised that labels on haloxyfop herbicide products will be amended to help ensure that domestic and international residue limits are complied with.

Post-emergent grass control in canola crops is commonly undertaken with herbicides containing the active ingredient haloxyfop, such as Verdict 520, Asset and Inquest.

GRDC acting plant health senior manager Ken Young said the new labels would clarify 'Directions for Use' and reduce the chance of misinterpretation.

"Haloxyfop labels are being amended to more clearly define when the products can be used in relation to the crop growth stage," he said.

"This will help ensure that users comply fully with domestic and international residue limits."

Haloxyfop product labels will be changed to read: 'Apply from two-leaf to eight-leaf stage of crop growth. DO NOT apply after the commencement of stem elongation'.

"Application must not occur after stem elongation has started because this can result in haloxyfop residues being above Australian and international Maximum Residue Limits (MRLs)," Ken said.

"It is important that growers and spray operators adhere to the new label directions so that residue standards are not breached and to protect Australia's important canola markets."

THE COMMERCIAL VIEW SCLEROTINIA

■ By Richard Quinlan, Planfarm

Growers will benefit from ongoing research to fine-tune best practice fungicide management for sclerotinia stem rot.

Research into the disease over the past five years has given farmers and researchers a deeper understanding of the disease and the influence the season can have on its progression.

Trials led by the Department of Agriculture and Food (DAFWA) and funded by the Grains Research and Development Corporation (GRDC) have shed more light on the optimum time to apply foliar fungicides.

In summary this work has highlighted:

- The importance of a two-spray strategy if the infection window for the disease is protracted;
- The need for growers to be flexible with the timing of fungicidal applications. If conditions are dry then disease onset can be delayed significantly which can reduce the number of sprays required or eliminate the need for fungicidal sprays completely;
- The importance of growers having fungicide on-hand, as the optimum spraying window – in most seasons when the crop is at the 15 to 30 per cent flowering stage – can be very short; and,
- That the disease can be significant and result in large yield losses. Doing nothing can be a very expensive decision.

In 2012 I also conducted trial work – funded by the GRDC Geraldton Regional Cropping Solutions Network (RCSN) – to better understand this damaging disease in the northern grainbelt of WA.

The one-year project was conducted in conjunction with DAFWA and other local agronomists.

We found that sclerotinia was most damaging in high-biomass crops, which was determined by soil moisture (linked to soil type and landscape position), adequate seasonal rainfall and the crop emergence date.

Even though 2012 was a very dry season in the northern grainbelt (sclerotinia is generally more damaging in wetter seasons like 2013), there were still crops in this region that lodged in places due to damaging levels of the disease.

The RCSN project found that canola susceptibility to sclerotinia increased on:

- Loam and clay soils that held moisture longer, compared with sandy soils;
- Shorter-season varieties that flowered earlier when the disease was sporulating;
- Paddocks where there had been reasonable disease levels in previous years; and,
- Crops that were early sown – leading to high crop biomass early in the season.



Richard Quinlan.

Standing stubble improves the microclimate for lentils and increases yield, regardless of the seasonal conditions

Lentils respond to stubble retention of prior cereal crop



■ By Cindy Benjamin

AT A GLANCE...

- Retained stubble can increase lentil yield and is unlikely to cause a decrease in yield.
- Greater yield advantage from standing stubble rather than slashed stubble, especially when lentils are sown later.
- Sowing lentils into standing stubble may provide further benefits to harvestability (eg. increased biomass, better plant and pod height and less lodging).
- Opportunity to investigate effect of individual processes (eg. season, planting date, stubble and variety) on yield.

LOW lentil yields across the lower Mid North of South Australia in the low rainfall years of 2006–08 prompted a three year trial to determine if sowing date and stubble management could influence yields. The results indicated that stubble retention can have a positive effect on lentil yields of up to 13 per cent.

Pulse agronomy researcher Michael Lines of the South Australian Research and Development Institute says their trials demonstrated that sowing lentils into standing cereal stubble improves yield stability, regardless of the length of the season or the amount of effective rainfall.

"The benefit is more pronounced in drier seasons, suggesting that the benefit lies mainly in conserving soil moisture," Michael says.



Michael Lines.



Retained stubble can increase lentil yield.

In 2010 a trial was established near Mallala (Mid North, South Australia) to test if lentil yield would improve if the crop was sown into the inter-row of standing cereal stubble. This treatment was compared to two other stubble management techniques:

- Slashing and retaining stubble; and,
- Completely remove stubble by burning or raking.

In addition to the three stubble management treatments the trials contained eight lentil varieties planted at three sowing dates – break of season, two weeks after the break and four weeks after the break.

"The stubble present in the trial was 30–35 cm standing height and ranged between 1.8 and 2.2 tonnes per hectare dry matter," says Michael. "The varieties included Boomer, Nipper, Nugget, PBA Blitz, PBA Bounty and PBA Flash."

The seasonal conditions varied across the three years of the trial, which helped indicate the conditions under which the most benefit is achieved from retaining cereal stubble. The season started in 2010 was considered average, followed by a wet finish. In 2011 there was a wet start and an average finish and in 2012 the season started normally and finished drier than average.

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TABLE 1: Summary of grain yield improvement (% of Removed/burnt stubble yield) from Slashed and Standing stubble treatments compared to the Removed treatment for six varieties and three sowing dates across three seasons in the Mallala region

Variety	Variety characteristics	2010		2011		2012	
		Slashed	Standing	Slashed	Standing	Slashed	Standing
Boomer	Late, high EV, high BM, prostrate	0%	0%	0–16% (M)	0–27% (L)	0–16% (E,L)	0–29% (E, L)
Nipper	Mid-late, erect, low BM	11%	12%	0%	0%	0%	13–34% (E, M , L)
Nugget	Late, industry standard	17%	11%	0%	0–21% (M)	0–33% (M)	0–38% (M, L)
PBA Blitz	Early, erect, low BM	12%	22%	0%	0–36% (E , L)	0–33% (M)	0–28% (E, M)
PBA Bounty	Mid-late, prostrate	0%	11%	0%	0–20% (E , M)	n/a	n/a
PBA Flash	Early-mid, erect	9%	9%	0–34% (M)	0–26% (E, M)	0%	0–30% (E, L)
Average stubble treatment response (all sowing dates and varieties) P<0.05		7%	10%	8%	11%	11%	18%
Season summary		Average start Wet finish		Wet start Average finish		Average start Dry finish	
Site mean yield (t/ha)		3.8		2.0		1.4	

Bracketed treatments denote which sowing date, Early (E), Mid (M) or Late (L), yielded higher than the Removed stubble treatment.

Bolded treatments denote the sowing date (E, M or L) where the Standing stubble treatment yielded higher than the Slashed stubble treatment.

Variety characteristics: EV = early vigour, BM = biomass, Early, Mid, Late refers to plant maturity, Erect or prostrate refers to plant growth habit.

The greatest yield benefit was seen in PBA Blitz with standing stubble retained. This erect lentil variety is often slow to reach canopy closure so there is usually more soil water evaporation compared to more prostrate varieties, which tend to quickly cover over the soil surface.



PBA Blitz – early burnt (left); early slashed (centre); and early standing (right).

Positive effect regardless of season

"When the results were analysed we found that stubble management had a positive effect on yield, regardless of the seasonal conditions," Michael says. "In 2010 significant two-way interactions were found with Sowing date x Stubble management and Variety x Stubble management. In 2011 and 2012 significant three-way interactions of Sowing date x Variety x Stubble management were generated."

Yield improvements of the Standing stubble over the Removed stubble treatment averaged 13 per cent across the three years. This significant yield response is thought to be largely due to soil moisture conservation but also factors related to the micro-climate within the lentil crop canopy.

"Along with reduced evaporation effects we also believe that most varieties benefitted from the protection and support that the standing stubble provided," says Michael. "Protection from the wind means the lentil plants do not need to put additional resources into thickening their stems to withstand the wind, and there is less displacement of soil from around the stems, and potentially less upper root breakage, when the stems are blown by the wind. The combination of more resources and less damage to the stem and roots may boost the production of flowers and pods."

The less erect varieties also benefit through support from the stubble by reducing lodging and assisting with harvestability (eg. raising the pods higher off the ground).

The greatest yield benefit was seen in PBA Blitz, an erect lentil variety that is often slow to reach canopy closure. This trait means there is usually more soil evaporation in a field of this variety compared to more prostrate varieties, which tend to quickly cover over the soil surface.

In contrast, Boomer has a high biomass and reaches canopy closure rapidly, reducing evaporation. This variety demonstrated the least yield response to stubble retention.

Farming system considerations

Michael says the decision to retain standing cereal stubble must be taken after considering possible disadvantages to the whole farming system.

Standing stubble can interfere with the proper operation of machinery and may have implications for disease, weed and pest management. Retaining stubble will lead to immobilisation of nitrogen and potentially stratification of nutrients in the soil profile. If the stubble interferes with herbicide application and incorporation there is the potential for herbicide resistance to develop over time.

To read additional relevant articles go to Pulse Update Annual at www.pulseaus.com.au

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Red brome confirmed resistant to glyphosate

ONE population of red brome (*Bromus rubens*) has been confirmed resistant to glyphosate in the central wheatbelt of Western Australia.

This is the first red brome population to be confirmed resistant to glyphosate in the world and is the third glyphosate resistant grass weed species found in Western Australia.

"This finding is of particular concern for no-till farmers who rely heavily on glyphosate for grass weed control prior to sowing and in non-crop areas such as fence lines and firebreaks," Department of Agriculture and Food, Western Australia (DAFWA) researcher Abul Hashem said.

Abul and DAFWA's Catherine Borger discovered the glyphosate resistant red brome under a Grains Research and Development Corporation (GRDC) funded project also involving the Australian Herbicide Resistance Initiative (AHRI).

Abul says growers must be even more vigilant in their autumn and spring weed control because resistant seedlings of this weed species were found that can withstand up to four times the normal rate of glyphosate.

The glyphosate-resistant red brome biotype was discovered in a long-term trial site where since 1999 DAFWA weed scientists

have studied weed population dynamics in response to long-term use of low and high label rates of glyphosate.

"Although the resistant biotype was found in a long-term trial site, the treatments mirror those commonly used by farmers to control weeds on fencelines," Abul said.

The closely related giant or ripgut brome (*Bromus diandrus*) has already evolved resistance to glyphosate in South Australia and Victoria.

While red brome is not currently a major grass weed in WA, it is widespread in paddocks and often found in fire breaks and along fences. Glyphosate-resistant brome populations have the potential to become a significant problem.

"Even though other brome grass species have developed resistance to Group A and B herbicides in WA, a number of herbicides from Group C, D, J, K, L and N are available to control this weed," Abul said.

"Weed management practices must include rotation of crops with herbicides applied at full label rates and use of non-chemical weed control practices to delay further resistance development.

"Growers who find any brome grass plants surviving herbicide application should send samples to DAFWA or commercial services for a 'Quick Test' in which plants are tested for herbicide resistance.

Landholders who suspect glyphosate resistant weeds on their property or roadsides should contact their relevant state expert and their council. Details of who to contact in each state are available from the Australian Glyphosate Working Group website http://www.glyphosateresistance.org.au/suspect_glyphosate.html

For more information on managing glyphosate and paraquat resistance visit the AGSWG web site www.glyphosateresistance.org.au

Information about sustainable integrated weed management (IWM) practices is available at www.ahri.uwa.edu.au

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



Red brome with giant brome in the background.
(Photo by Agronomo)



Red brome plants treated with 4 L/ha glyphosate (540 g/L) at the Merredin Dryland Research Institute showing the glyphosate-resistant population (left) sampled from a long-term trial where low and high rates of glyphosate were applied for 11 years, compared with a susceptible population (right) sampled from nearby unsprayed waste land.
(Photo by Catherine Borger)

Is self managed grain trading the answer to insolvency risk?

■ By Profarmer Australia analysts

"A grain farm's business is growing and selling crops – it is not providing credit to grain buyers."

RECENT insolvencies in the grain trade, including that of Tamworth based LGL Commodities going into external administration in June, is raising some serious questions about the security and model grain growers use to market and sell their grain.

The call for some form of 'protection' from insolvency events is a natural response. Victorian Farmers Federation Grains Group, in an effort to support their members, has flagged licensing of grain traders as a potential solution.

Although the motive is sound, Profarmer believes there could be some unintended consequences of licensing that could increase the cost of compliance on all grain businesses; big and small, good and bad. The point is that you can't legislate against businesses going broke. That is one of the realities of the free enterprise system. Licensing won't prevent insolvencies.

One of the ironies of licensing costs is that it may hit the smaller, regional players and merchants, many of whom have great records of loyal service to their farming communities over generations and are an integral part of the 'fabric' of the Australian grain trade.

If we squeeze some of them out through costly regulation or licensing, farmers may be left with just a handful of big players to buy their grain. This results in less competition and potentially other market failures in terms of efficient movement of grain. The net result of this of course is potentially less transparency, and lower prices to growers.

Seller beware

The harsh reality is that selling grain – like any commodity – is 'seller beware'. Farmers have to take responsibility for their selling decisions. Chasing an extra \$5 per tonne from a party you don't know carries the old adage... "If it looks too good to be true, it probably is!"

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benefit to growers. Any grain transaction done on the Clear Grain Exchange ensures the seller retains title of their grain until buyer funds are received by Clear's independent custodial account. The independent custodian ensures the funds and title to grain remain under the respective parties' ownership and Clear never has any interest in either. Hence it provides a secure settlement facility.

The Clear Grain Exchange's maximum of seven business day payment terms reduces a seller's exposure to market fluctuations.

This season for the first time, growers who participate in the forward market also have access to Clear's secured settlement facility via the launch of the ClearFORWARD market. This will be an industry first for forward contracts and will provide a new level of security for growers.

A grain farm's business is growing and selling crops, it is not providing credit to grain buyers.

Case study – ask yourself this question!

You are selling your second-hand Land Cruiser for \$10,000. A buyer arrives – test drives it, and agrees to buy it for \$10,000.

Do you hand over the keys and let them drive it out the gate and await payment in 30 days? Not a chance! Yet, with grain, a truck trundles out the farm gate with about \$10,000 on board, title has passed to the buyer, and the farmer waits 30 days for payment.

It has been the way grain has traded for years, and it may change into the future. But if you as a seller are prepared to wait 14 or 30 days for payment, you need to manage this risk.

This is no different to any other business that offers payment terms to their clientele. Another method is offering the grain parcel on the Clear Grain Exchange, which allows all market participants to view and bid on it, whilst utilising the secure payment facility.

The Australian grain industry is very aware of maintaining the integrity of the buy and sell process. Without confidence in credit, markets simply don't work, and that is no good for anybody from end consumer to the farm gate. The industry needs profitable farmers, traders, storage providers and consumers. This is part of the reason industry bodies such as Grain Trade Australia (GTA) work hard on an industry Code of Practice for members. It helps ensure integrity around contracts, dispute resolution processes, and importantly, helps to educate the entire industry to better inform participants around trade and mitigating risk.

Profarmer understands the anger and emotion arising from unpaid grain. But there are ways to mitigate this risk without regulation – which will not guarantee payment anyway. Self managed grain trading through a fully transparent, secure and proven online platform may just be the way of the future.



Domestic grain markets

Wheat

- As we near the pointy end of the season it is prudent to be prepared for the possibility of lower prices at harvest.
- Domestic prices are performing better against historical values than CBOT futures with strong domestic basis providing some price protection in domestic markets.
- Strong basis may pose potential down side risk, particularly in export oriented markets.

Despite good long term fundamentals, international wheat values have come under pressure from the short term production surplus relative to global consumption. International wheat values have done a lot of work to the down side since May, but there are still a number of potential down side factors that may continue to influence international values.

Domestically we've had some respite in the form of strengthening basis. Whilst the current \$A value of Dec14 CBOT wheat futures reflects a decile 1.07 (the bottom 10.7 per cent of values observed from 1/08/09 to current) new crop APW in Geelong in late July was a decile 3.26.

Since international values changed direction in May we've seen domestic basis strengthen \$20–\$60 per tonne and whilst strong basis has provided welcome respite against falling international values, some of this may be supported by slow grower selling. Therefore, we feel there is risk that if grower selling were to pick up, there is potential for some of the



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July 23, 2014

domestic premium to erode. This is especially the case in southern states where exports will remain the focus – less so in northern drought affected markets.

With markets, anything is possible, and we may well see prices change direction between now and harvest. However, in case they don't we feel it prudent to 'bear-proof' your marketing plan so that you can maintain control no matter what happens.

Canola

- Nationally, canola values are below a decile 1, or the bottom 10 per cent of observations from August 2009 to current.

Canola values are down in the doldrums, so it's difficult to recommend forward sales. ICE canola is trading at a decile 1.16 and Pt Adelaide new crop values are a decile 0.44 based on price observations from August 2009 to current.

In the *Profarmer Australian Grain Annual* we said "one of the rules of thumb with canola is to finish forward sales by late August, and to stand aside during September and October".

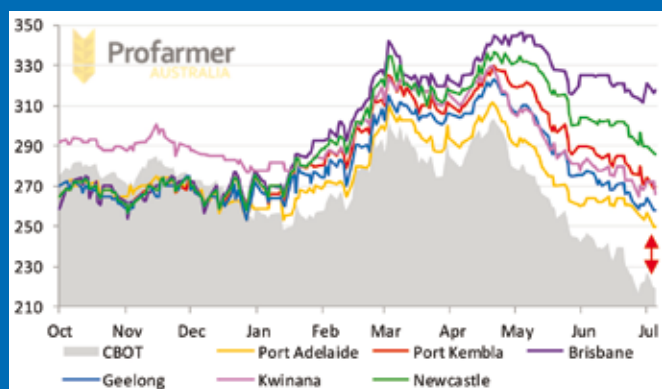
The message here is that although we are currently in the typical forward marketing period for canola there is still some way to go before Canadian harvest pressure is expected to flow through the market and we may see some pricing opportunities in the lead up to the Canadian harvest.

In mid July we wrote that if canola production is travelling to plan, it may be time to act on forward sold Matif hedges and capture basis. The chart below shows us that Matif (French futures exchange) basis is nearing five year highs – but we feel the EU harvest is currently pressuring Matif futures. For those who are comfortable with their current production outlook, we suggest that now is the time to be reviewing these positions.

Buying back Matif futures at today's values would cost us about A\$460 per tonne, resulting in a gross profit on the hedge of \$118 per tonne before costs. If we deduct swap costs (we've assumed \$10 per tonne) our net position is \$108 per tonne, and then sell cash at \$465 per tonne Pt Adelaide for a return of \$573 per tonne.

We could have sold for cash in March for \$530 per tonne and been done with it – particularly considering domestic values have fallen \$65 per tonne since then – but the improvement in basis over that same time period means that we have been able to out perform the cash price in March by \$43 per tonne after costs. ■

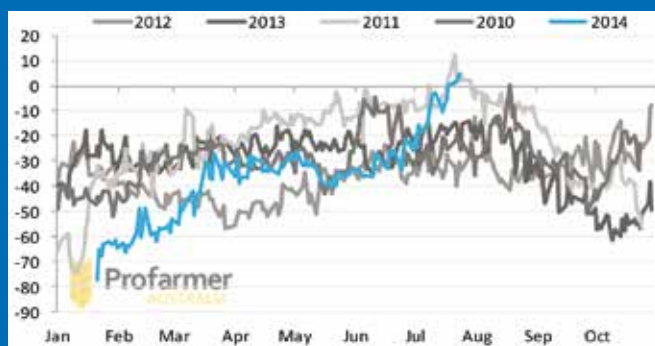
2014–15 APW wheat



CBOT Wheat Decile



Matif Forward Basis Pt Adelaide \$/t



Underground dams can help drought-proof the nation

UNDERGROUND dams offer a promising way to make Australia's number one foodbowl, the Murray-Darling Basin more resilient against droughts, a leading water scientist says.

Professor Tony Jakeman of the National Centre for Groundwater Research and Training and the Australian National University says his group's research in the Namoi River region of northern NSW, shows there is good potential to store water underground during time of flood – for use in time of drought.

"It's a chance to turn 'a land of drought and flooding rains' into one that stores and uses its water endowment far more wisely," he says.

The team's research also indicates it may be cheaper to store water in buried aquifers rather than in surface dams, which suffer from heavy evaporative losses as well as high construction costs.

Their research has found strong support among the farming community for further testing of the 'underground dams' concept for use on individual farms, as well as scope for local or regional water saving.

The findings may be timely. The Australian Bureau of Meteorology recently issued an alert saying there is a 70 per cent chance of a new El Niño event, the first since the end of the Millennium Drought.

"The Murray-Darling Basin (MDB) covers a seventh of the

continent, is the nation's main food bowl, and has nationally and internationally significant natural and cultural assets. Its water resources are under particular pressure due to over-extraction of surface flows in some areas, barriers to connectivity, declines in water quality and the depletion of aquifers," Tony says.

Innovative options

"But our research indicates there is an opportunity to rectify some of these challenges with the use of managed aquifer recharge (MAR), or water banking as it is sometimes called.

"Our view is that we could benefit from more innovative options which manage surface and groundwater use together, such as managed aquifer recharge."

Tony says the work by NCGRT in the Namoi has shown that managed aquifer recharge may be feasible at farm scale, and potentially at regional scale, that it is cost effective and that the idea of storing water underground enjoys broad community support.

"So long as you have surplus water which you could pull out of streams or rivers when there is plenty – for instance during a flood – and you have suitable aquifers to hold it, as well as suitable conditions on the surface to get it into the aquifer, then water banking should be seriously considered as an option."

Getting the water into the aquifer is usually achieved either by building a 'soak' – a depression built on suitably permeable soils which holds water until it leaches down into the aquifer – or else by injecting it with a pump (either solar or electrical powered). The first option is generally cheapest, he says, but depends on the suitability of the landscape.

Water banking can be adopted at farm scale, in volumes suitable for supplementing irrigation supplies in a dry season – but it can also potentially be used to store water for towns, cities and industrial uses.

Australia-wide application

"The work was done in the Namoi region, and shows there is excellent potential for managed aquifer recharge there. But the principles apply right across Australia – wherever there are rivers that flood, suitable aquifers and communities or industries which need water."

The Namoi work is an important demonstration of the potential for establishing a National Water Bank, the Director of NCGRT, Professor Craig Simmons says. Craig recently issued a national call for governments at all levels and water users to consider creating a National Water Bank to ensure Australia need never run short of water in future.

The National Water Bank concept involves a monitored network of underground and surface resources that use underground aquifers to store water, with the advantage that underground storage reduces both large evaporative losses and infrastructure costs compared to reservoirs and dams.

"Tony Jakeman and his team have provided invaluable practical proof of the concept of Australia storing substantial amounts of surplus water underground in an area which is strongly reliant on water for agricultural production. This complements other scientific research in places such as Adelaide and Perth which has shown its potential for city use.

"It adds up to a major case for Australia taking the idea of



Tony Jakeman.

water banking in underground aquifers far more seriously. This is the sort of infrastructure development that will meet the needs of a growing nation with growing industries far into the future."

The National Centre for Groundwater Research and Training is an Australian Government initiative, supported by the Australian Research Council and the National Water Commission.



Craig Simmons.

"Groundwater accounts for 95 per cent of Australia's available fresh water. It is a vital reserve for agriculture, mining, manufacturing and urban use and supports industry worth \$34 billion. If we look after it, it will look after us - for all our foreseeable future," says Craig.

National Water Bank: A new 'Snowy Scheme'

He says that a National Water Bank could be among the nation's most farsighted infrastructure projects, on a par with the Sydney Harbour Bridge or Snowy Mountains Hydro Scheme.

"Underground dams have two big advantages over surface dams – first, they lose little of their water to evaporation and second, they are cheaper to build. Instead of vast earthworks and flooded valleys, you just need a few pumps or soaks to inject water at the right time into carefully-researched aquifers. That water can then generally be recovered at need."

The storage ability of a National Water Bank lies in relatively lower-cost items like infiltration ponds, injection bores, computer models and sensors rather than in very costly earthworks and concrete associated with major dams and reservoirs costing hundreds of millions of dollars. And if the amount of water being stored and discharged from an aquifer is known, it can always be managed sustainably.

"Like a financial bank balance, the idea of a National Water Bank means being able to know, at any given time, how much you have on hand, and what are your deposits and withdrawals."

"It is vital we better understand our national groundwater storage capacity, its recharge rates, and the potential for us to augment and top up our aquifers with artificial recharge."

For more information: Professor Tony Jakeman, NCGRT and ANU, ph 02 6125 4742 or 0404 851 689; Professor Craig Simmons - Director NCGRT, ph 0405 184 645.

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Cold snap reduces vector numbers but virus has hit canola yields

AT A GLANCE...

- Green peach aphid (GPA) is a widespread and damaging pest in horticulture and broadacre agriculture. Growers need to have a resistance management strategy in place for this pest.
- Grain crops vulnerable to GPA attack include canola and pulses.
- Within Australia, growers rely heavily on four chemical classes to control GPA – carbamates, synthetic pyrethroids, organophosphates and neonicotinoids.
- High levels of resistance to carbamates and synthetic pyrethroids are widespread across Australia. Moderate levels of organophosphate resistance are also common in GPA populations.
- Due to the way aphids reproduce, resistant individuals can soon dominate a landscape with widespread use of the same insecticide.



The green peach aphid (*Myzus persicae*).
(Photo: David Cappaert, Michigan State University, Bugwood.org)

THE onset of cold and wet weather across the southern region in July has caused a general decline in the population and activity of green peach aphid (GPA) – the principal insect vector of beet western yellows virus (BWYV) of canola. But the large infestations of GPA in autumn and early winter have resulted in extensive canola crop losses.

Experts say that although aphid numbers have now decreased, canola crops could remain susceptible to yield loss from BWYV infection until the mid-podding stage. Greatest yield loss occurs if infection takes place at the rosette stage. Infection after mid-podding usually results in minimum yield loss but oil quality can still be affected.

GRDC Senior Manager Plant Health, Dr Ken Young, encourages growers to continue monitoring for aphids and to

consult with their local agronomists in determining the need for treatment.

"Vigilance is critical, especially with a pest like GPA as populations can build rapidly and significant infection and crop damage can soon occur," Ken said.

Growers should be prepared to apply insecticides in late winter or early spring to limit the spread of the virus once aphids start to become more active and begin their spring flights. But if a crop is already widely infected with BWYV then insecticides may not be warranted except to prevent direct feeding damage from aphids – which is very unlikely.

Monitor for symptoms

BWYV can be transmitted by relatively few aphids feeding on plants, and symptoms may not present themselves for up to five weeks post infection. Severe symptoms are likely to be caused by a combination of virus infection and aphid feeding damage. In addition to canola, pulse crops may also be at risk in spring.

In South Australia, up to 10,000 hectares of canola in the Lower North and Mid North regions has been severely damaged this season and a number of crops have had to be re-sown.

Virus-like symptoms have also been reported in canola crops in the Upper North, on Eyre Peninsula, upper Yorke Peninsula and in the upper South-East.

In Victoria, BWYV has been found in numerous canola crops in the Wimmera and Mallee, where some reports suggest that more than 50 per cent of all canola crops are now infected. Unusually high BWYV autumn infections have also been detected in canola paddocks in New South Wales.

Experts believe the rainfall in February–March created a 'green bridge' of weed hosts for BWYV and GPA and warm temperatures into early winter provided ideal conditions for aphid population development, flight activity and widespread colonisation of canola crops.

Insecticide resistance compounds the problem

The presence of insecticide resistance in many GPA populations has compounded the situation. Studies funded by



BWYV symptoms in canola. (Photo: Mick Faulkner)

the GRDC have found that the extent of insecticide resistance in GPA across Australia has escalated as a result of heavy reliance on insecticides to manage grain pests, placing strong selection pressure on the insect to develop resistance and leaving growers with limited future control options.

A key part of the recently announced funding is to provide

further information about which insecticides will be effective in controlling aphids (see article below).

More information on BWYV and GPA is available via:

GRDC Hot Topic website: www.grdc.com.au/BWYV

GRDC Resistance Management for Green Peach Aphid Fact Sheet:

www.grdc.com.au/GRDC-FS-GreenPeachAphid

EMERGENCY FUNDING TO TACKLE BWYV

In late July the GRDC announced an emergency funding package of \$315,000 in response to a significant outbreak of beet western yellows virus (BWYV) in canola crops in the southern region.

Transmitted by green peach aphid (GPA), the combination of virus and aphid feeding has caused considerable damage and crop losses in parts of South Australia and Victoria, and infection has also been detected in southern New South Wales.

GRDC Managing Director, John Harvey, says that in the early stages of the outbreak, initial identification of BWYV as well as testing of GPA populations for insecticide resistance was undertaken with support from existing GRDC investments.

"In recognition of the severity and extent of this outbreak, the GRDC has now provided an additional injection of \$315,000 as emergency funding," John said. This funding will be used to:

- Appoint part-time co-ordinators to conduct a forensic analysis of canola paddocks including management practices, aphid activity and weed levels that have contributed to the severity of the outbreak. The co-ordinators will also assist with collection of aphid samples for resistance testing in the systematic survey. This information will be used to ensure best advice is available to limit potential damage in future years. This work will be led by Dr Jenny Davidson and Mr Greg Baker, of the South Australian Research and Development Institute (SARDI).
- Co-ordinate communication to growers and advisers nationally to ensure they have the best information available to limit further damage. This will include presenting at

regional field days and providing updates for e-newsletters. The co-ordinator role in SA has also been assisted with an additional \$40,000 in emergency funding provided by the South Australian Grain Industry Trust (SAGIT).

- Undertake a preliminary assessment of virus levels in canola varieties to identify if there are any useful levels of resistance to BWYV for future sowing recommendations.
- Collect aphid populations in the southern region in a targeted manner and test for resistance to key insecticide groups to determine effective options for ongoing aphid control in both canola and pulses. This work will be led by Dr Paul Umina of cesar.

Further understanding of BWYV outbreaks

John said that through GRDC's existing investments in virology, a number of activities will be undertaken to assist in further understanding of this BWYV outbreak. These activities will include:

- Drs Angela Freeman and Mohammad Aftab, from the Department of Environment and Primary Industries Victoria, assessing the severity of BWYV in canola and pulses in spring, undertaking studies on vectors and host range of BWYV and continuing their work with the Department of Agriculture and Food Western Australia (DAFWA) on the development of a predictive model for BWYV in canola and pulses.
- Dr Joop van Leur, of NSW Department of Primary Industries, leading a GRDC project to investigate viruses of canola and pulses in northern Australia, including the impact of BWYV in canola and its link to pulse crops such as chickpea.



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Farming in Foreign Fields...



New Rowtrac matches Anashka Farm's needs to the inch

TOM Robinson's family has been farming wheat and canola at Anashka Farm for five generations. This 1620 hectare property in Hoyleton, South Australia, is also a showcase for innovative farming practice, having moved to zero-till farming in 2002 and now using Controlled Traffic Farming (CTF) to improve soil health – and boost crop yields.

Tom and his father Ashley received their new Case IH Steiger Rowtrac tractor in April 2014 and finished seeding with it in mid May.

"The whole tractor has exceeded our expectations. The ride is fantastic, it's smoother than my ute," he says.

He is using the Rowtrac to take care of all seeding, plus he says he'll add a three-point linkage spreader for spreading urea, and then run a grain cart in the summer. "I've basically taken the job of three tractors and rolled them into one."

First saw it in the US

He first saw the Rowtrac when it was released at AgriConnect in Kansas, when he was visiting farms in the Midwest to see the long-term impact of zero-till farming practice. "I really liked the four track design. And now it has 120 inch (3 metre) wheel centres it matches our CTF practice exactly."

Times have changed – Tom's grandfather Greig Robinson with his 1945 LA Case tractor, and Tom with his new Steiger Rowtrac, which he says fits perfectly into his controlled traffic operation.

To carry out CTF you need all vehicles and weight bearing wheels running on the same tracks, minimising traffic compaction. To do this, wheel centres and equipment widths must be standardised.

Tom says that for them CTF is the natural next step after committing to zero-till farming.

"It's all about yield, really," says Tom. "Fuel prices are going up, commodity prices are going down. We can't rely on decent rainfall. So we've got to do whatever we can do to protect yields – zero-till and CTF seems to be working for us."

In fact, soil compaction can reduce yield by as much as 30 per cent, according to a recent article about the Robinson's operation in SPAA's Precision Ag News. The amount depends on the soil type and rainfall. It can reduce water infiltration, root growth and even soil biological activity.

"The choice of Rowtrac was more to do with how it fits our package – I am willing to wait to get the right equipment to fit

our farm operation," explains Tom. "We're also running a Case IH Patriot sprayer, with 15 inch tyres, so we can use both the Rowtrac and Patriot in-crop and it will limit compaction."

Tom sees the new equipment as an investment in soil health, with the long-term benefits of CTF on soil improvement and water use efficiency.

He says the Rowtrac also gives him a high horsepower tractor that can run on a narrow track, decreasing the overall footprint but still giving a lot of grip. And his neighbours have been impressed by the lack of berms on the corners.

"I've had three or four guys have a run on it and they're very impressed by the way it turns," he says.

The Robinson family are self-declared "Case IH people."

"We still have a 1945 Case tractor that was my grandfather's," says Tom, adding that he's not 'colour blind', but that they always "seem to get great service (from dealers), and great results from the equipment."

The Robinsons purchased their Rowtrac tractor through local Case IH dealer, Ramsey Brothers at Riverton. ■

TACKLING RURAL DEPRESSION, ONE STEP AT A TIME

Bruce Healy, Case IH Brand Leader, is fully committed to the company's partnership with mental health organisation *beyondblue*. In fact, he's taking this responsibility 126,000 steps further by walking the New York City Marathon this November, and he hopes to raise \$5000 for *beyondblue* through his efforts.

Case IH has teamed up with *beyondblue* to raise awareness of depression and anxiety in farming communities, and the agricultural machinery company has pledged to donate at least \$100,000 a year to the charity.

"At first, it was a personal fitness challenge for me. I was overweight. I wanted to lose a few kilos and improve my health, so I set a pretty big goal to get me motivated," says Bruce.

"But after talking with our dealers and customers out there in the field, I realised just how important *beyondblue*'s work is to rural and remote communities. Just about everyone working in agriculture knows someone dealing with depression or anxiety.

So I'm dedicating my marathon to the charity.

Studies show farming communities in Australia experience mental health issues at twice the rate of the general population – with financial pressure, social isolation and long hours just some of the causes of stress and depression.

"Farming is a tough business and while Australian farmers are known for their resilience, this doesn't mean that people don't feel the impact of a string of bad seasons, or even the stresses of everyday life," Bruce said.

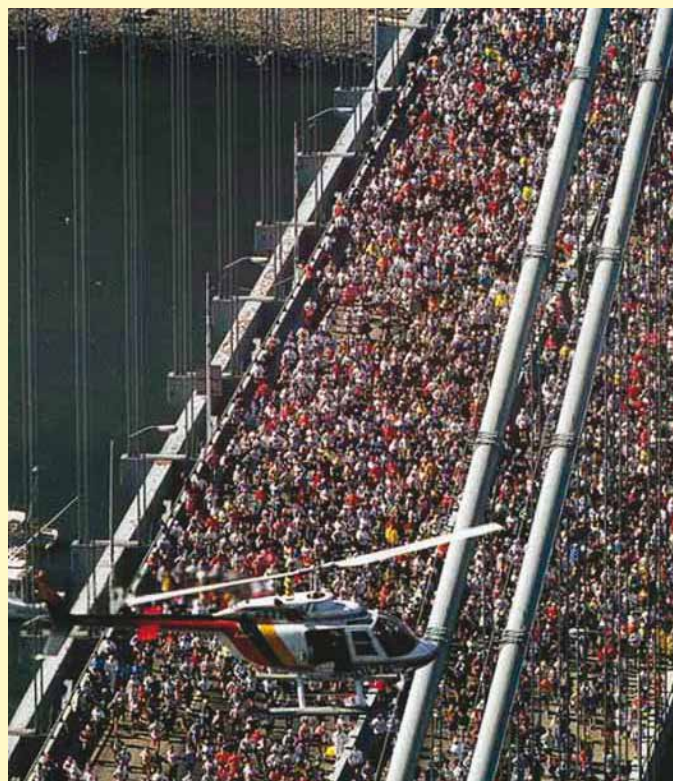
Bruce has proven his own resilience, having already shed almost 20 kg and fitting in at least a 20 km walk most weekends. With just three months to go, he has now registered for his first marathon.

To help Bruce raise funds for *beyondblue*, visit <https://give.everydayhero.com/au/bruce-healy> or find Case IH Australia on Facebook and follow the link.

If you or someone you know needs support, learn how to tackle the problem by calling the *beyondblue* support line on 1300 224 636 or visiting beyondblue.org.au



Case IH Australia's Brand Leader, Bruce Healy, is getting his running shoes on and taking part in the New York City Marathon this year both as a personal fitness challenge, and to raise money for *beyondblue*.



On November 2, Bruce will be one of an expected 50,000 starters making their way across the bridges and through the five boroughs of New York City.

Making a barley fish feed product

■ By Sandra Avant, Agricultural Research Service – USDA

FOR centuries, barley has been used in beverages, soups, stews, breads, and other foods. It also has become a major component in livestock feeds for cattle, sheep, pigs, and other animals. But for fish, barley didn't quite make the grade as a feed ingredient – until now.

The need to develop more plant-based protein sources for aquafeeds is increasing because the availability of small ocean fish – used to make fishmeal and other feeds – remains constant while demand increases dramatically. One of the challenges for fish-feed manufacturers is to procure ingredients that contain enough available protein to meet the dietary needs of fish.

A process that improves the nutritional value of barley has been developed by scientists at the Agricultural Research Service's Small Grains and Potato Germplasm Research Unit in Aberdeen, Idaho, and Montana Microbial Products LLC (MMP) in Missoula, Montana.

"Barley feed grain typically contains about 10–12 per cent protein, but an ingredient needs to contain 40–60 per cent protein for carnivorous fish like rainbow trout," says ARS fish physiologist Rick Barrows, who is stationed in Bozeman, Montana. "An enzymatic process was developed to concentrate the protein in barley by removing the carbohydrates, which are then turned into an ethanol coproduct, thus utilising all the nutrients in the grain. The barley protein is not exposed to high temperatures during concentration, so its digestibility is very high."

Scientists tested the barley protein concentrate in rainbow trout to determine its palatability and digestibility – the percentage of nutrients available to the fish. "Protein digestibility and amino acid availability were in the mid-90 per cent range," Rick says.



Agricultural Research Service scientists have formulated a new feed ingredient suitable for rainbow trout (above) and Atlantic salmon. The feed component contains a highly digestible barley protein concentrate produced with technology developed and patented by ARS and an industry collaborator. (Photo: Stephen Ausmus)

Barley for salmon

To evaluate the effects on growth in other fish, research leader William Wolters and fish physiologist Gary Burr, at the ARS National Cold Water Marine Aquaculture Center in Franklin, Maine, fed diets containing barley protein to Atlantic salmon

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– one of the most widely cultured species in the world. Most salmon diets are about 40 per cent protein, scientists say. During a 4-month feeding trial, salmon were fed diets of either 11 per cent or 22 per cent barley protein concentrate. These fish were compared to salmon fed a standard commercial fishmeal diet. William and Gary found no significant differences in growth among the three groups of fish. But fish fed the diet containing 22 per cent barley protein concentrate had significantly greater energy retention – 34 per cent – than the fish fed the other diets.

“Energy retention refers to how much energy we are putting into the fish and how much energy is staying in the fish,” Gary says. “Fish that have higher energy retention are using the feed more efficiently.”

This research, which was published online in the *Journal of Applied Aquaculture* in December 2013, showed that barley protein concentrate is a suitable feed ingredient for salmon and offers an alternative to the more expensive available sources, like fishmeal and soy protein concentrate. A recent collaborative study conducted at the University of Sterling in Scotland confirmed that barley protein is a nutritious feed ingredient for salmon, William says.

Commercial product ahead

The barley-processing technology has been patented by ARS and MMP. The company received a license for the technology and recently built its first commercial prototype plant in Montana to produce the alternative fish-feed ingredient. The primary purpose is to produce barley protein for use in trout-feeding trials, says MMP’s Clifford Bradley.

“Our idea is to run this prototype plant for a year to 18 months and then build the first real commercial facility,” he adds. “The testing program will tell us how big we should build the first facility for the commercial product and what the market is going to look like.”

That market could be huge, according to Clifford. Aquaculture is still growing very rapidly, so the demand for high-protein ingredients is increasing at a steady rate. Typically, high-protein ingredients are selling at about US\$1200 a tonne or more, while fishmeal is about US\$1600 a tonne.

“It’s potentially a multibillion-dollar market,” he adds.

Counting the benefits

Besides being less expensive than other protein sources, barley protein concentrate offers other benefits. The phosphorus from bones and fins in fishmeal is not very digestible. “Most of the phosphorus from fishmeal goes into the water as a pollutant,” Clifford says. “Barley protein has much less phosphorus, but it is more digestible and better utilised by the fish.”

Barley protein concentrate adds to the toolbox of feed manufacturers, reduces cost, and gives farmers an alternative to fishmeal. It also creates additional markets for small-grain growers, Rick says. For example, the new process is perfect for use with malting barley that is too high in protein, due to weather conditions or other factors, to sell to beer companies.

“We’re trying to develop plant-based ingredients for fish so we don’t have to rely on fishmeal from the ocean,

which has reached its maximum harvestable level,” Rick says. “This helps the environment. Also, if we could produce more fish with less costly, sustainable ingredients, the consumer would ultimately benefit from a safe, abundant, and nutritious food source.”

Rick Barrows is in the USDA-ARS Small Grains and Potato Germplasm Research Unit, Fish Technology Center, 4050 Bridger Canyon Rd., Bozeman, MT 59715; Ph: +1 (406) 994-9909.

William Wolters and Gary Burr are with the USDA-ARS National Cold Water Marine Aquaculture Center, 25 Salmon Farm Rd., Franklin, ME 04634; Ph: +1 (207) 442-2713 [Wolters], Ph: +1 (207) 442-2716 [Burr].



Fish nutritionist Rick Barrows (right) captures trout from two metre diameter tanks for technician Jason Frost to weigh and measure. These trout were fed fishmeal-free, plant-based feed. (Photo: Stephen Ausmus)

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Never mix trifluralin and....

Mum – 'blue and green should never be seen'

Wife – 'never mix swirls and stripes'

Dad – 'never drink on an empty stomach'

Sam Kleemann – 'never mix trifluralin and a single disc seeder'



It will come as no surprise to many that researcher Sam Kleemann from the University of Adelaide found that trifluralin gave poor ryegrass control and reduced crop establishment when wheat was sown with a single disc opener in three trials between 2008 and 2012. Some growers favour single disc, zero till seeding because the lack of soil disturbance may reduce weed emergence. Sam observed this phenomenon in one trial, but the low ryegrass number in the zero till plots went on to produce a lot of seed due to low competition from the crop.

What is encouraging from this research is that some triple disc seeders do throw enough soil to incorporate trifluralin and give good crop establishment. Sam also found that the new herbicides Boxer Gold and Sakura gave good weed control with good crop

safety with a range of seeding machinery – although these new herbicides are not currently recommended for use with disc seeders in Australia.

This AHRI insight is a summary of research that was conducted by Sam Kleemann, Chris Preston and Gurjeet Gill from the University of Adelaide. The research was published in the *Weed Science Society of America* journal in April 2014.

We know three things about trifluralin

1. It must be incorporated into the soil soon after application to avoid losses through volatilisation. A very thin layer of soil is enough to stop volatilisation of trifluralin.
2. It is tightly bound to organic matter so interception by crop



Single disc seeder + trifluralin = poor crop establishment + poor weed control.



Sakura + Single disc seeder = good crop establishment + excellent ryegrass control.

residues on the soil surface can reduce its effectiveness.

3. Mixing trifluralin with wheat seed results in significant reductions in wheat establishment. Ideally a seeding system should provide some separation between crop seed and trifluralin.

And there are three rules that every agronomist lives by. In priority order they are:

1. Don't kill the crop;
2. Kill the pest (weeds, insect, disease); and,
3. Achieve 1 and 2 at the lowest possible cost.

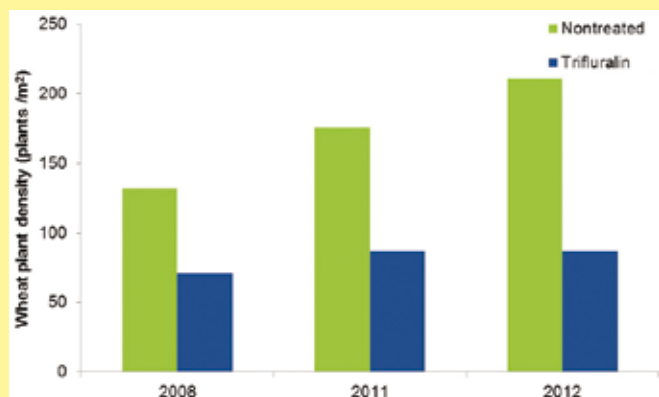
In his research, Sam Kleemann found that the combination of trifluralin and single disc seeding broke rules 1 and 2 – crop damage and poor weed control – the agronomist's (and farmer's) worst case scenario. At least trifluralin is cheap!

Rule #1 – Don't kill the crop

Crop establishment

Trifluralin at 1.5 L/ha roughly halved the establishment of wheat sown with a single disc opener at each of three trials (Figure 1).

FIGURE 1



Boxer Gold also caused a reduction in wheat establishment sown with a single disc in 2011 and 2012 (Figure 2).

FIGURE 2



Rule #2 – kill the weeds

Ryegrass control

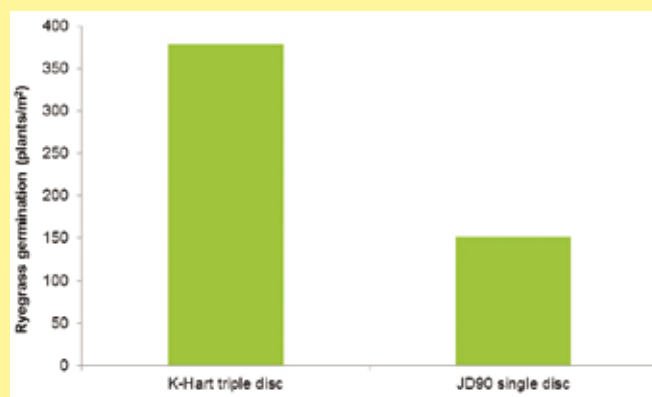
The 2012 trial gave the best comparison in ryegrass control between seeding systems and herbicides.

Let's break down the results

1. **More soil disturbance = more ryegrass germinates.** The triple disc machine stimulated a bigger ryegrass germination

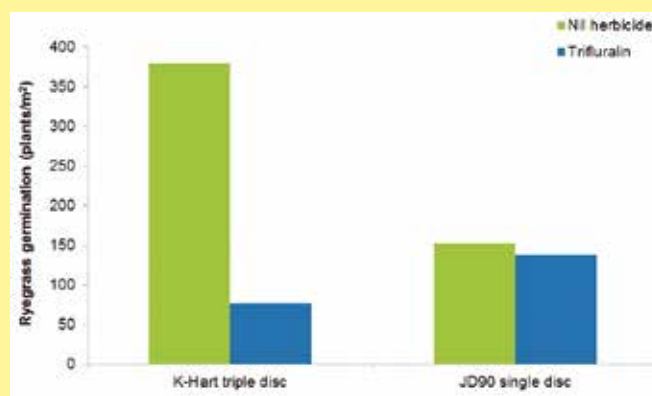
than the single disc machine in the absence of herbicide due to the level of soil disturbance (Figure 3).

FIGURE 3



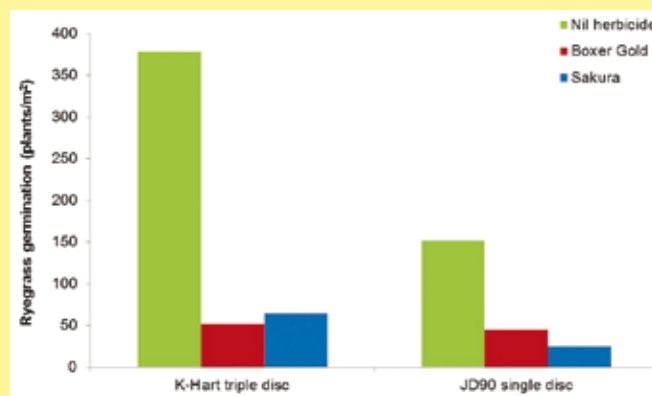
2. **Only 10 per cent ryegrass control with trifluralin when sown with a single disc compared to 80 per cent control when wheat was sown with triple disc.** The single disc machine did not give enough soil disturbance to cover the trifluralin with soil resulting in trifluralin volatilising and reducing the effective rate of trifluralin (Figure 4).

FIGURE 4



3. **Excellent (70–86 per cent) ryegrass control with Boxer Gold or Sakura regardless of seeding machine.** The combination of Sakura with single disc seeding achieved the highest level of ryegrass control in the trial. Perhaps the low soil disturbance with the single disc reducing the stimulation of ryegrass emergence, combined with the non-volatile herbicide Sakura was the key to success (Figure 5).

FIGURE 5



4. The lowest wheat yield was achieved with trifluralin and single disc seeder. Trifluralin reduced wheat establishment by 59 per cent which reduced the crop's ability to compete with weeds. Conversely, the highest yield was achieved for the treatment with the lowest ryegrass density and best crop safety – single disc opener plus Sakura.

TABLE 1: Wheat yield (kg/ha) for triple disc versus single disc seeding for a range of pre-emergent herbicide treatments at Roseworthy, SA in 2012

	Nil herbicide	Trifluralin	Boxer Gold	Sakura
K-Hart triple disc	3340	3880	4290	4220
JD90 single disc	3420	3260	4130	4360



K-Hart triple disc.

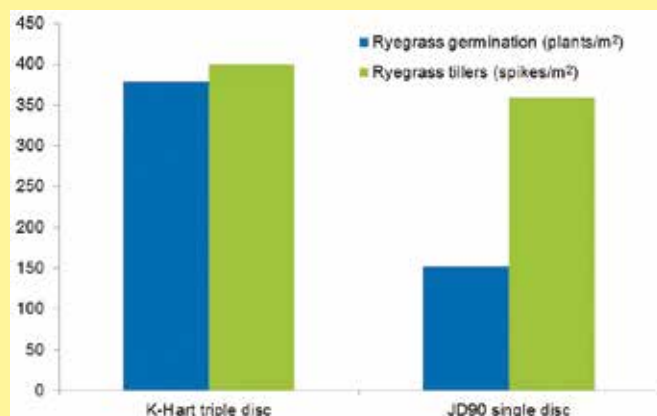


John Deere JD90 single disc.

Crop competition

Wheat plant vigour for single disc seeding systems was observed to be low compared to other seeding systems. This allowed the ryegrass to tiller well in this low crop competition environment. The low soil disturbance of the single disc seeding system may appear to be beneficial given the low numbers of ryegrass that germinated in these plots, but these ryegrass were able to set a lot of seed due to a lack of competition from the crop (Figure 6).

FIGURE 6



To sum up

Many grain growers have steered away from disc seeding machines because they would like to use trifluralin for ryegrass control. This research shows that this is true for single disc openers, but there are other disc machines that are now capable of achieving good ryegrass control with trifluralin with good crop safety.

TRIAL DETAILS

This research was conducted on sandy loam soil over calcareous clay at Roseworthy in the lower North region of South Australia. Wheat was sown into faba bean or lentil stubble. Annual rainfall ranged from 307 mm to 419 mm in the years of the trials.

In this research the single disc seeder (Austil in 2008 and JD90 in 2011 and 2012) was compared to a K-Hart triple disc seeder and a Primary Sales knife point and presswheel seeder (2008 and 2011). The herbicides trifluralin 480 1.5 L/ha, Boxer Gold 2.5 L/ha (Prosulfocarb + S-metolachlor) and Sakura 118 g/ha (Pyroxasulfone) were applied immediately pre-sowing of the various seeding machines.

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'ASK AN EXPERT'

■ 'Look for escapes – all year' with Principal Research Scientist (Weeds), Agri-Science Queensland, Michael Widderick

JUST as an integrated weed management program is planned across the year and even across a full crop rotation cycle, so too is it necessary to monitor every weed management tactic to check for escapes.

Dr Michael Widderick says even a well-planned approach to weed management is unlikely to be bullet-proof. "The reason we use a variety of tactics in weed management is because we can't rely on any one tactic to be 100 per cent effective, every time," he says.

"Each tactic is chosen to achieve a specific purpose and growers need to know the outcome of that tactic to help plan the next step."

"Unfortunately, there is often not much time between a few suspect plants and paddock-wide herbicide resistance," he says. "It is very important to monitor weeds and act early if you are suspicious."

Michael says the practice of weed management is as much about observing what happens and responding to it as it is about having a number of tactics in place to keep driving down the weed seed bank.

What should I be looking for after a fallow weed control tactic using herbicide?

Short answer: Patches of survivors.

Longer answer: Herbicide resistance is much easier to see in a fallow paddock. If you have applied a herbicide treatment, go back a week or two later and look for individual plants or small patches that have survived the treatment. Often herbicide resistance will be first noticed when other weed species in a paddock are still controlled but one species is relatively unaffected. This usually starts in patches but can quickly spread across the paddock if the patches go undetected and set seed.



Intensive management of a patch of survivors like this can stop the spread of herbicide resistance

What should I do if I notice weed escapes in-crop?

Short answer: Test seed or plant samples.

Longer answer: Managing a weed blow-out in-crop is very difficult. Weeds that have 'escaped' the controls implemented at sowing, or that have germinated after the pre-emergent herbicide has degraded, will often not be seen until they have grown above the crop and set seed. Taking samples for testing against the herbicides you used will provide important information for the next step in your weed management plan. Such an event may trigger the use of a harvest weed seed tactic such as narrow windrow burning or, in extreme cases, green or brown manuring.

What should I do with weeds in non-crop areas that survive a herbicide treatment?

Short answer: Try another tactic.

Longer answer: Herbicide resistant weeds in non-cropping areas do occur and they are a source of seed that can lead to an infestation in cropping paddocks. Many non-crop areas such as roadsides, fencelines and around buildings are routinely treated with glyphosate. Any over-reliance on a single tactic is likely to end with herbicide resistance in weeds and can easily spread across a farm.



Agri-Science Queensland Principal research scientist, Michael Widderick encourages growers to observe what happens after each weed management event and respond to what they see.

HOW TO ASK A WEEDSMART QUESTION

Ask your questions about testing for herbicide resistance, or any herbicide resistance management strategy, using Twitter @WeedSmartAU or on the WeedSmart website <http://www.weedsmart.org.au/category/ask-a-weedsmart-expert/>

Questions will be answered online, through our interactive blog, and may also be shared with other growers through this column.

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

Cabbage aphids living on the edge

THE latest research results show that cabbage aphids are most abundant along crop edges in canola paddocks. As well as outer crop edges, they may also aggregate inside a paddock on canola plants around dams, patches of natural vegetation or contour banks harbouring weeds.

Researcher and PhD student Dusty Severtson said improved knowledge about the distribution of cabbage aphids, one of the primary aphid species in canola crops, could be used to optimise crop inspections and precision-targeted spraying to control the pest.

The results also show that the insects prefer to colonise the underside of leaves in the bottom portion of the canola canopy first, rather than the racemes (flowering spikes).

"Therefore, scouting for early and emerging cabbage aphid infestations should focus on inspections of lower leaves," Dusty said.

The Grains Research and Development Corporation (GRDC) funded research is being conducted by Rusty, of The University of WA (UWA) and Department of Agriculture and Food (DAFWA), under the supervision of UWA Associate Professor in Applied Entomology, Christian Nansen.



Researcher Dusty Severtson, of UWA and DAFWA, in a New Norcia paddock – one of the sites for field trials researching the distribution of cabbage aphids.

"Field trials in the York and New Norcia areas of WA in 2013 showed that cabbage aphids – which can cause feeding damage to canola crops in late winter and spring – tend to be distributed along crop edges," Rusty said.

"Cabbage aphids were most commonly found within 20 to 30 metres of the crop edge and were rarely detected further inwards.

"Where significant infestation of cabbage aphids was detected further into the crop, these locations were either near a tree line or contour bank harbouring weeds.

"This shows that the probability of detecting cabbage aphids is highest along crop edges and non-crop regions within a paddock, especially where wild radish is, or has been present."

Rusty said that as well as highlighting the importance of weed control, the results implied that a border spray might be just as effective at controlling cabbage aphids as a full paddock spray, saving growers time and money.

"Additional benefits from partially spraying a paddock include the retention of beneficial insects, which can prevent secondary flare-ups of aphids, and a reduced likelihood of aphids developing resistance to insecticides," he said.

Rusty said 2013 glasshouse trials involving experimental infestations of cabbage aphids on canola plants clearly showed that the insects spread quite slowly from an initial point of infestation.

"Therefore, it probably takes several weeks from when cabbage aphids first colonise a canola crop to when they become detectable on racemes – where the insects have traditionally been sampled from," he said.

"We had previously assumed that winged cabbage aphids flew directly onto racemes, but this is actually not the case.

"Cabbage aphids can reach relatively high numbers in the lower canopy before they will move on to the racemes.

"To find aphids early, canola growers should inspect the underside of leaves in the lower canopy."

Growers and others in the industry are encouraged to send reports of diseases and pests including cabbage aphids to the DAFWA PestFax service at pestfax@agric.wa.gov.au.

**Further information: Dusty Severtson, UWA and DAFWA – Ph. 0422 157 769
Email: dustin.severtson@research.uwa.edu.au**



New research has revealed that cabbage aphids are most abundant along crop edges in canola paddocks.

New grain drier on the scene

PERRY of Oakley Ltd is a family manufacturing business now in its third generation. It is the UK's oldest and most experienced manufacturer of grain driers and grain handling equipment – their products are now available to the Australian market.

Perrys have appointed Aust-Mech as their main distributor in Australia. Aust-Mech was chosen because they are a similar family run manufacturing business. They also understand the importance of manufacturing a quality product and providing good after-sales service and support.

Aust-Mech engineers are trained on how to service, maintain and troubleshoot drier problems should they arise. They will also carry a stock of critical spares so parts availability is not a problem within Australia. This will ensure that customers can receive the same level of service as they would from a local manufacturer.

Aust-Mech are situated in Dalby and manufacture the well known Tubeveyor product.

Product range

Perrys manufacture commercial and agricultural products for use on farms and commercial grainstores in the UK and around the world. They export to a number of countries and currently have about 20 driers in New Zealand which have operated successfully over the past decade.

Their product range includes:

- Grain driers with capacities from 8.5 to 150 tonnes per hour (tph) based on 5 per cent moisture extraction.
- Chain and flight conveyors, bucket elevators, screw conveyors, belt conveyors, mechanical intake conveyors and aspirator cleaners – all available from agricultural to industrial specification and up to capacities of 600 tph.

Perry's first drier in Australia

Perry's first on-farm drier has been successfully installed and commissioned. It belongs to TN Bailey, 'Pine Ridge', Quirindi in northern NSW. It is a 40 tph continuous flow drier based on drying feed wheat from 20 to 15 per cent (or 53 tph extracting three per cent moisture from 16 to 13 per cent).

The conveying and elevating equipment supplied is all 60 tph.

Perry sent a supervising engineer from the UK to build the drier and handling equipment with engineers supplied by the customer.

The customer's key reasons for purchase were:

- To enable more timely harvesting of the existing crop so planting and other field activities can commence earlier than if the crop had to dry in the field.
- To enable the crop to be harvested when the quality is at its best and to achieve best prices.
- Ease of drying. The new system is simple to operate and has a fully automated Programmable Logic Controller (PLC) system for both the drier and the handling equipment.
- Increased drying capacity. This provides the opportunity to offer drying facilities to other farmers.

The customer chose Perrys because they could provide the complete package of handling equipment and the drier plus they had the expertise and knowledge to enable them to design the drying plant that was required.

Key features of the Perry system

- Continuous mixed flow design so overall power requirement is low.
- 25 to 30 per cent of the drier is used for cooling. This gives the best opportunity to cool the grain as much as possible with ambient air.
- Touch Screen PLC control panel. The drier program was written by our own engineers so we know every aspect in detail. If the drier panel is connected to the internet our UK staff can connect to the panel and diagnose problems and even control and adjust all of the drier functions. This also provides the ability to text or email drier status reports to the operator's mobile phone and the drier performance can be monitored and adjusted by PC from the farm office or house.
- The handling plant can also be controlled by the PLC as an extra cost option.
- Oil or gas burners.
- Ledge free internal design to minimise the amount of chaff and straw etc from lodging inside the drier.
- Fully galvanised construction internally and externally for a long service life.
- Pneumatically operated shutter discharge.

For more information contact Aust-Mech on 07 4662 4200,
E: sales@austmech.com or visit www.austmech.com



Next generation in grain testing

FOSS announces the Infratec Nova, a sixth generation of the renowned Infratec NIR testing platform with new functionality to help grain receivers handle more grain samples in less time.

New levels of speed and usability make it possible to test grain at rates up to 20 per cent faster than other NIR solutions.

Simple is reliable

A tablet-like touch screen interface and Foss' purpose built intuitive ISScan Nova Touch operator software makes the instrument easy to use minimising operator training requirements.

The sample area has been improved to simplify cleaning and the new unit is 30 per cent smaller and lighter than the Infratec 1241. It is more transportable and now takes up less bench space.

New technology is up to 20 per cent faster

The all-new 4th generation monochromator inside the Infratec Nova, sets new standards in NIR performance. Intelligent handling of sub-samples reduces analysis time by up to 20 per cent without loss of accuracy. Infratec measurements are based on the highly stable Foss ANN grain calibration including data from over 50,000 samples and offering unbeatable consistency even during difficult harvests.

The Infratec Nova is fully backwards-compatible, allowing cost-free calibration transfer from earlier Infratec versions.

True networking capability

Networking capability can sometimes mean little more than a connection to the internet. Infratec Nova provides true networking allowing calibration updates to be made from a remote computer. Experts working remotely can also access instruments to monitor performance and troubleshoot.

Contact Simon Kirkman E: info@foss.com.au or www.foss.com.au/grain



The new Infratec Nova from Foss.

Research Updates in the north

WITH an excellent line up of speakers delivering new and essential information to northern region growers and advisers, the GRDC Research Updates scheduled for August are a must for growers seeking to improve their financial bottom line. Topics covered will include:

- Maximising chickpea yield on the Western Downs – row spacing and population trials with new varieties, yield optimisation and amount of N fixed. (Kerry McKenzie, DAFF Qld)
- Nitrogen profitability in wheat for yield and protein gain – timing, products and tips for optimising the return on \$ spent. (Richard Daniel, NGA)
- The economics of deep P placement over time. (Mike Bell, QAAFI)
- Soil structural decline – organic matter, infiltration rates, fertility and impacts on land use suitability. (Ram Dalal, DERM)
- Soil water and risk management for summer cropping at Condamine – how much soil water at sowing affects yield and profit outcomes in different types of seasons? Probabilities for a profitable crop in 2014. (Jeremy Whish, CSIRO Ecosystem Sciences)
- Nematodes – summer and winter crop varieties and rotation impacts on RLN multiplication, and nematode impacts on crop yield. (Kirsty Owen, DAFF Qld and Brendan Burton, NGA)
- Herbicide management in the fallow – managing glyphosate resistant barnyard grass, liverseed grass and feathertop Rhodes grass. Why using Group A herbicides is a short term option. Options for soil residuals and what's the experience with tillage? (Michael Widderick, DAFF Qld and Mark Congreve, ICAN)
- Faba beans – agronomy and harvesting options to optimise performance and manage risk. (Garry Onus, Landmark Moree)
- Maximising chickpea yield on the Darling Downs – how does 4.7 t/ha sound? Row spacing and population trials with new varieties, yield optimisation and amount of N fixed. Comparison with faba beans. (Kerry McKenzie, DAFF Qld)
- Mungbeans – new variety improves options in the Central and Western Downs. Where and why would you fit mungbeans into the rotation and agronomy to optimise returns? (Gordon Cumming, Pulse Australia)
- How full is my profile? How much water do I need to fill it? Using EM to speed soil classification and estimate soil water to drive crop resourcing decisions (Neil Huth, CSIRO Ecosystem Sciences)
- Robots in the paddock and drones in the air. A different future (Andrew Bate, Grower Bendee Farming)

Northern Region Updates in August 2014

- Warra (Memorial Hall), Tuesday August 26.
- Condamine (Sports Club), Wednesday August 27.

Northern Region Updates in Feb/March 2015

Adviser Updates

- Coonabarabran (Town Hall), Feb 25 & 26, 2015
- Goondiwindi (Community Ctr), March 3 & 4, 2015

Grower Updates

- Warren (venue TBA), February 27, 2015
- Talwood (Community Ctr), March 5, 2015

Further information: Please contact Erica McKay or John Cameron at ICAN Pty Ltd on 02 9482 4930 or e-mail: northernupdates@icanrural.com.au. Registration form can be downloaded from: <http://icanrural.com.au/updates.html>

Australian winter crop outlook



■ NAB Agribusiness – Rural Commodities Wrap, July 2014

- The 2014-15 Australian winter crop season has generally been off to a good start in Western Australia, South Australia, Victoria and southern New South Wales. After a long and hot summer which saw summer crop production fall 33 per cent, decent autumn rainfall across many wheat growing regions have improved growers' spirits.
- The season has started particularly well in Western Australia, South Australia and the Riverina in New South Wales, while in Victoria growers are hopeful of average yields if decent spring rains offset lower subsoil moisture levels.
- The situation in northern New South Wales and Queensland is less optimistic. In the Darling Downs, good pre-planting rainfall arrived in March but low subsoil moisture combined with a number of heavy frosts is placing pressure on crops. NAB agribusiness bankers report that without decent rains over July and August yields will likely decline.
- ABARES forecasts that Australian wheat production will decline 9 per cent this season, led by falls in Western Australia and South Australia. At NAB we consider that developments since the release of the ABARES estimate on June 11 suggest that wheat yields in Western Australia, South Australia and Victoria will be better than the ABARES estimate, while ABARES' projection of higher wheat production in Queensland may be optimistic
- El Niño remains the biggest concern for the industry over the coming months, although the outlook has become somewhat less concerning over July. While the lack of El Niño onset into winter has given growers in south-eastern and Western Australia a good start to the season, an emergence of the phenomenon in the spring could put pressure on wheat yields across eastern Australia. Although the impact of El Niño on conditions is difficult to predict, few grain producers would welcome its emergence before November.

NAB Agribusiness Managers' comments from the field

The season has started off remarkably well with good opening rainfall in April/May and good follow-up rain in June/July in the Upper Great Southern area.

Farmers are fairly optimistic of above average wheat yields, the main risk potentially is frost damage in September. The only drawback at the moment is lower prices, but farmers are hoping for increased yields to offset price.

Michelle Halstead, Narrogin WA

Crop development stage overall is in advance of the same time last year and we have a full subsoil moisture profile to hold us in good stead for the remainder of the year. There are small cases of areas suffering from water-logging.

Michael Laidlaw, Clare SA

In the Wimmera Mallee we are tracking to average or slightly above average in some patches, particularly the northern Mallee, which received above average summer rainfall. With that being said, yields will be largely determined by the strength of the spring rains, as subsoil moisture levels are low, following a long, dry summer.

Whilst the threat of an early onset of El Niño remains, should this hold off until early November, we expect yields to remain largely unaffected.

Brad Sudholz, Horsham Victoria

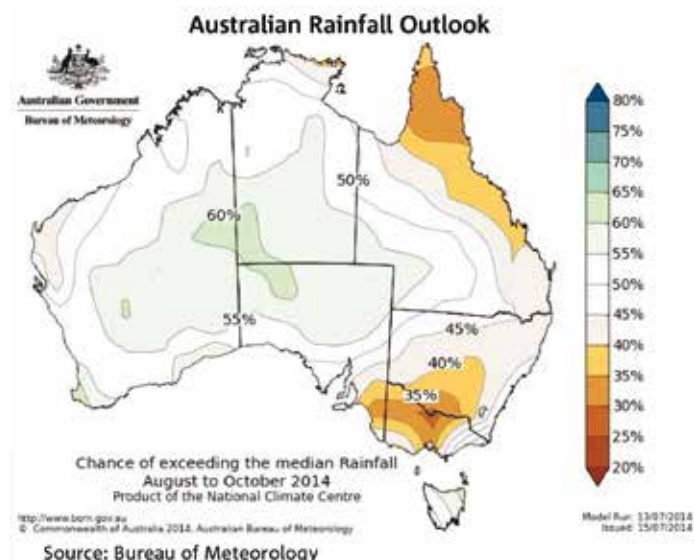
It's been a very good start to the year and we're hearing farmers 60, 70, 80 years old saying this year is the best start they've ever seen. It has been a very casual type of year, with everything more or less as intended and spraying and spreading urea haven't seen many problems. If there are decent rains in July and August we should get a good crop.

Randall Holmes, Wagga Wagga NSW

Generally growers in most areas of the Darling Downs have been able to plant some, if not all of their planned winter cropping area. Good pre-planting rain in March, combined with recent smaller but patchy falls, has seen crops remain in a relatively healthy condition. The month of July saw winter well and truly arrive with a number of heavy frosts occurring and these, combined with a lack of subsoil moisture, have growers hoping for further rain to ensure crops continue on a positive path.

With a long way to go and a 'not so great' forecast – the Darling Downs winter crop could go either way with rain over the next month (or a lack of it). I would forecast that across the Darling Downs, unless we get 1 to 2 inches of rain by the end of July/August, we will see a significant drop off in yield expectations.

Sarah Short, Goondiwindi QLD



District Reports...

July–August 2014

Western region



NORTH

The season to date has generally been very good in our region. Good opening rains in late April and early May have us off to a very good start. Rains have generally been good but some areas have been drier than they would like to be since early May.

Crops are growing very well. Wheat is from mid tillering to head emergence. Canola and lupins are budding to full flower. Yield potential is very high but the year to date rainfall is only moderate to low!

Nitrogen rate decisions, and the punt required on rainfall from here, are the toughest decision in the farm calendar. Rainfall tallies are moderate and N amount applied so far reflect this. The big question is will a big rain finish the year into a bumper.

Weed control is close to complete on most farms and crops are very clean.

Some wind erosion did occur on some of the later mould board ploughed paddocks. These crops are struggling to recover.

We are in the race for a very good season but the winter falls have not been convincing that a good season is on the cards. But the crops look better than the rain they have had.

Let's hope August can deliver a season making 50 mm rainfall to get this promising season home.

Peter Norris

Agronomy For Profit and Synergy Consulting, Geraldton
July 17, 2014

SOUTH COAST

Seasonal conditions on the South Coast are mixed. May and particularly June were very dry – also the north-westerly winds have been very strong and have been accompanied by a few warm days above 25°C.

Fortunately rain in early July saw most of the region receive between 25–60 mm. Areas close to the coast immediately around Esperance are tracking on Decile 7, Ravensthorpe on Decile 6 and all other locations are tracking between Decile 2 and 4.

Given the dry windy conditions most crops look remarkably good apart from some areas of poor establishment due to non-wetting soils. From an agronomy perspective, there has also been very few abnormal issues to deal with.

The biggest decision most growers are now facing is how much top-up nitrogen to apply. We have all been busy using soil test results in nitrogen calculators, season forecasts, soil moisture



Frank Demden from Precision Agronomics Australia preparing to launch their eBee UAV drone to measure normalised difference vegetation indices (NDVI) in a Nitrogen Rate Response Trial in long term controlled traffic farming at Scaddan on the South Coast of WA.

probes, *Yield Prophet*, weather apps (such as *Climate*) and plant tissue tests to help in making these tough decisions.

Hopefully the remainder of season delivers average rainfall and the region can at least produce an average crop.

Quenten Knight,
Agronomist, Precision Agronomics Australia
July 18, 2014

Southern region



MALLEE

Mallee annual rainfall deciles range from 4 to 7, while GSR deciles vary from 5–9. This puts the Mallee growing season in good stead. Dr McIntosh (CSIRO) at the recent BCG Expo suggested that 'normal' randomness in rainfall could be enough to get at least minimum crop yields through to harvest. Recent news from the BOM suggesting that a strong El Niño is unlikely is very positive news for the Mallee region.

District Reports...

July–August 2014

Northern region



DARLING DOWNS

Winter crop

It is a real struggle this winter with the only decent rainfall being the early May falls which allowed the limited planting that has occurred – and since then no falls over 5 to 10 mm. Growers have been looking for the opportunity to plant mostly wheat, but the window will be closed by the time this report is published.

There has been a reasonable plant of chickpeas on the Eastern Downs but less on the Central Downs and these have emerged fairly well in most cases. There has been a little bit of frost damage to the leaves, and some cases of mice and bird attack especially where double cropped into sorghum stubble, but most crops are growing well.

The main crop that did get planted was barley with an increase in the area sown this season probably due to both timing of the May rain and the good projected price. Most growers were looking for the next rain to plant wheat – but this went missing – so only 60 per cent of the intended wheat area is in.

Early crops of barley have shown some leaf disease, mainly with the spot form of net blotch, but overall, crops have grown well although dry patches are now beginning to show in many paddocks. Some crops planted very early have been in head and frosted and these are being cut for hay or silage. The wheat is struggling to get its secondary roots growing.

There is some canola planted but again the early crops are flowering and subject to frost damage. The few faba beans tried this winter have been suffering frost damage to the pods, and some heliothis attack, and like many of the advanced crops, are running out of moisture.

Summer prospects

The stored soil moisture for the summer crop is limiting with over 50 per cent of the anticipated area well short of a full profile. There has been a lot of soil testing this winter and not enough paddocks have good soil moisture below 60 cm.

There is renewed interest in cotton but irrigation supplies are short and the prospect for good rain for dryland crops is not strong with the current outlook. But if rain came there will be an increase in the dryland area coupled with a reduction in the irrigated area.

Rainfall deciles

Rainfall duration (mm)	Ouyen	Swan Hill	Sea Lake	Birchip	Hopeton
Jan–Jun	169 (7)	187 (7)	154 (6)	129 (4)	136 (5)
Apr–Jun (GSR)	96 (7)	141 (9)	114 (8)	86 (5)	106 (8)

Given the warmer temperatures, particularly early in the growing season, crops are now well advanced. At the end of June, degree days were about 10 days ahead of usual, but in reality some crops would appear to be a month ahead of where they would normally be at this time – a result of warm moist soil.

Purpling canola crops over the past three weeks have been the topic of interest. Beet western yellow's virus (BWYV) has been the most likely cause – a virus transmitted by green peach aphids. Even though temperatures are cool, a number of growers have decided to spray insecticide now to lower the aphid vector numbers, while others are waiting to make a decision on whether to spray or not when temperatures warm up – approximately 18°C. Green peach aphids are difficult to control as they have high resistance to many common insecticides.

Moist, warm conditions which have assisted crop growth have also helped increase insect populations this season.

Cereal yield potential ranges from 1.5 to 3.5 tonnes per hectare depending on soil moisture, crop rotation and nutrition status.

A substantial amount of nitrogen has been top-dressed this season.

De-Anne Ferrier
BCG Research & Extension Officer, Birchip
July 18, 2014



Purpling canola crops in the Mallee are probably the result of BWYV infection.

District Reports...

July–August 2014



Soil testing at Braemar on Qld's Darling Downs. Very few paddocks have moisture below 60 cm.

There will be a large plant of sorghum on both the spring and summer plants – rain permitting – and there is strong interest in the pulse crops. Spring mungbeans should have a good price if they can be produced, and the summer plant will have both mungs and soybeans. The maize area may reduce this year with the reduction in irrigation water supply.

Hugh Reardon-Smith
Agronomist, Landmark Pittsworth
July 18, 2014

WESTERN DOWNS

The winter crop got off to a very soft start with good moisture and warm conditions. This has led to crops advancing a couple of weeks ahead of schedule. The season now in contrast has had plenty of frosty conditions with very little in-crop rainfall. This has resulted in a large proportion of wheat, barley and canola crops looking for a good drink in the very near future to provide enough moisture for flowering and grain fill.

A fair bit of the disease 'net blotch' in barley has been getting

around due to some dewy mornings which spread the fungal infection – particularly in barley on barley cropping situations. Some early fungicide went on with herbicide sprays to give some protection. But with the dry conditions and stressed crops, follow-up applications will not be warranted as the disease should not spread and it would not be economically viable unless further rainfall is received.

Chickpeas have been coming on well with some early crops just starting to flower. Surprisingly, high numbers of *Helicoverpa* have been found in some situations even during these cold conditions.

Hopefully all crops, even though they are ahead of schedule, can escape any frosts during the flowering and grain-fill periods and some rainfall to finish off crops is received.

Nikolaus Fritz
Agronomy – Landmark, Miles
July 21, 2014

SOUTH BURNETT

Key issues

- No good news at all.
- Summer crop yield and quality at an all time low.
- Significant winter crop areas still not planted.
- Crops starting to show drought stress.
- Some early planted crops showing frost damage.

2014 will go down as one of the worst seasons on record for crop farmers in the Burnett.

It was surprising how well some of the crops responded to good March rains after being written off at the end of February. The very mild conditions through May and early July allowed crops to develop that would normally have been frosted.

The main beneficiary crop of the late rain and mild autumn was peanuts. Many crops were set to be straight baled without threshing. But they slowly matured and were threshed and hay made from the stubble. One grower said that it is the first time in 40 years of growing peanuts that he had pulled peanuts in July. He had threshed peanuts in July, but never pulled them.

Peanut yields and quality have been very low and quality very poor – but it has at least allowed some growers to cover some of their costs. Yields of the best parts of the paddock were about 1.0 tonne per hectare instead of 2.5 tonnes per hectare and many were only half that. Quality was very poor with payments of \$350 to \$500 instead of double that.

No peanut grower would have made money this past season. In fact, no dryland crop farmer would have covered costs this season.

Virtually no dryland bean crops were planted – of those that were, most failed.

Barley and wheat were planted in late April. This was the only real planting opportunity for winter crops on the lighter soils. It was taking a risk with frosts, especially as it was a very mild May and June and many crops bolted. It was fortunate that most crops were barley as they withstood the frosts better than wheat. The coldest night in Kingaroy was -5.7°C .

Quite a few barley crops were sprayed for spot form of net blotch. The mild conditions with many dews and fogs meant the disease pressure in the vegetative stage was extreme. Several barley crops were also sprayed for aphids.

Very difficult to find any good news stories and grower optimism is at an all time low.

Ian Crosthwaite
Agronomist, BGA AgriServices, Kingaroy
July 18, 2014

Weather

Rainfall: Central Queensland remains extremely dry with 10–15 mm of rain which fell across grain growing districts on June 14 – the only fall for June–July 2014. This was sufficient for wheat crops to grow secondary roots and will assist the crop to stand but will do very little to increase yield in struggling, droughted crops.

The days have mostly been warm (mid 20s), and since mid June, the nights cool to cold. Emerald can expect to experience between 0 and 15 frosts per year – 2014 has been at the colder end. Two of the coolest towns on the Central Highlands are Clermont which has experienced 15 frosts in the past month, the coldest being –4.5°C and Rolleston which has had 11 frosts, the coldest –2.5°C. Both Clermont and Rolleston had their coolest morning on July 12.

Summer crop

Sorghum: The early planted sorghum crop (planted January 2014 – around 30,000 hectares) has been harvested. Farmers were generally pleased as moderate yields (2.5–3 tonnes per hectare), an outcome of a fairly dry summer, were compensated by good prices – about \$300 per tonne delivered port. There were a few exceptional crops (over five tonnes per hectare) in the Dysart district but also plenty of drier paddocks across CQ with lower yielding crops (under one tonne per hectare).

Harvest of the later planted crop (February 2014 – about 50,000 hectares) will continue through to early August.

Dry-down of the sorghum crop has been frustratingly slow which is not unusual for crops maturing during May–July. Frost will assist dry-down especially in crops with late developing heads.

Lodging of stressed sorghum crops has been widespread and has forced many farmers to harvest high moisture grain and incur the added cost of grain drying.

Low protein sorghum has been fairly common and indicates low soil N levels. Limited protein testing of the sorghum crop by Grain Growers Ltd has shown a range of protein levels from a high of 11 per cent (Rolleston), a low of 6.7 per cent (Middlemount) and an average of about 9.0 per cent.

The price of sorghum has dropped to around \$250 per tonne, delivered port (Mackay/Gladstone), most of which is headed for southern Queensland livestock production.

Mungbeans: Harvest of the summer planted mungbeans crop is complete. Dry growing conditions made for a challenging harvest as most crops were very short. Low levels of puffy pod

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)		2014 rainfall to date (mm)		Summer 25yr Annual Average (mm)		2013–14		Autumn 25yr Annual Average (mm)		2014		Winter 25yr Annual Average (mm)		2014 to date		Spring 25yr Annual Average (mm)		2013	
Emerald Qld	554		215		250		125		118		95		61		10		120		141	
Toowoomba Qld	673		289		281		64		134		233		82		32		179		140	
Roma Qld	590		234		248		96		135		121		73		25		137		120	
Goondiwindi Qld	619		261		251		83		133		164		97		39		139		135	
Narrabri NSW	642		299		228		57		125		200		128		56		162		124	
Gunnedah NSW	665		323		242		66		122		205		130		71		178		75	
Dubbo NSW	611		434		200		148		136		227		127		106		153		91	
West Wyalong NSW	446		312		117		66		90		173		117		91		126		104	
Wagga Wagga NSW	545		338		133		80		121		164		152		113		144		52	
Swan Hill Vic	327		205		73		70		66		133		92		39		96		64	
Bendigo Vic	524		327		110		59		105		177		171		138		138		116	
Horsham Vic	392		192		77		27		71		98		135		75		110		123	
Lake Bolac Vic	537		233		119		51		101		101		163		103		153		147	
Murray Bridge SA	370		281		64		109		77		89		130		102		101		54	
Kadina SA	345		269		55		74		77		132		123		87		90		54	
Cummins SA	394		357		46		93		86		96		177		184		84		94	
Esperance WA	623		323		80		41		145		121		255		190		143		161	
Wagin WA	405		173		49		2		96		96		171		77		89		103	
Northam WA	402		254		45		7		84		127		190		124		84		100	
Mingenew WA	368		154		32		12		92		102		176		40		65		75	
Moora WA	389		135		45		0		89		36		183		100		73		39	
Mullewa WA	320		187		50		28		90		136		134		39		47		41	

Last rainfall reading July 26, 2014.

District Reports...

July–August 2014

disease were observed in a few crops. Yields were modest with 0.75–1.0 tonnes per hectare about the average for most crops.

Winter crop

Wheat and chickpea: Wheat planting began in the second week of April and continued through to mid-May when farmers either run out of paddocks or soil moisture. At best, most paddocks had only a 1/3–2/3 PAW (plant available water) and many had less. Rain that fell on June 14 was sufficient in most paddocks to develop secondary roots and may assist crops to stand at harvest – but was a long way short of adding yield. Unseasonal warm weather during May–June resulted in many crops going to head early.

I estimate about 130,000 hectares of wheat and 35,000 hectares of chickpea has been planted with about 2/3 of the chickpea crop north of Emerald and 1/3 (10–15,000 hectares) south of Emerald and in the Dawson/Callide.

Chickpea planting started in early May and at this stage appears to be handling the dry weather better.

There are reports of stem frost damage in wheat in the Callide. And chickpea pods and flowers were lost as a result of frost in the Dawson and Central Highlands but for most farmers, drought will be the biggest limitation to yield.

Livestock and pastures

All pastures are frosted or hayed off and most are grazed short. Local cattle are generally in good store condition. Cows with big weaners have dropped in condition. Prices for local weaners at early weaner sales crashed when big numbers from

north Queensland were delivered to either fill paddocks that would normally be supplied by local weaners or oversupplied the demand at the saleyard.

Meatworks with full books and low saleyard prices have created a sombre and sometime desperate mood in the cattle industry.

Water

Overland water flow is not normally expected until mid-summer so surface water will continue to be an issue for many graziers.

The Fairbairn dam is currently at 50 per cent capacity or 645,245 mL. Most on-farm water storages are empty. Unless there are unseasonal river flows before spring there will be no irrigation on farms relying on rivers for irrigation.

Maurice Conway

Department of Agriculture, Fisheries & Forestry

Emerald, Queensland

July 18, 2014

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ANSWER TO IAN'S MYSTERY TRACTOR QUIZ

The tractor is a German Porsche Diesel Standard, and yes designed by Dr Ferdinand Porsche. The Standard was introduced in 1960 and featured an air cooled two cylinder four stroke diesel engine of 30 hp. The engineering integrity associated with Porsche cars was carried over into the Porsche range of tractors.





What's on the *Greenmount Travel* radar for 2015?

South America, Cuba & Central America will be two trips offered in the second half of 2015 but let us know what's on your travel wish list and we will do our best to make it happen. Send an email to Greenmount Travel with your suggestions – travel@greenmountpress.com.au

For more than 20 years Greenmount Travellers have criss-crossed the globe visiting amazing agricultural, geographical and cultural destinations in China, Russia, South & North Americas, Cuba, Mexico, Canada, India, Tibet, Africa, Eastern & Western Europe, Scandinavia, United Kingdom, SE Asia, Japan, The Kimberleys and Nuigini.

These were our destinations in 2014

Scandinavia

One of the most beautiful and hospitable parts of the world, we have had two very successful tours through northern Germany, Denmark, Sweden and Norway – with an optional pre-tour small-ship Arctic Circle cruise.



North America

A perennial favourite *Greenmount Travel* tour, although we seem to go to different places every time we visit the US and Canada. Well, it's a big area, but there are some things that cannot be missed, such as a visit to New York or a trip through the Canadian Rockies and the Calgary Stampede.



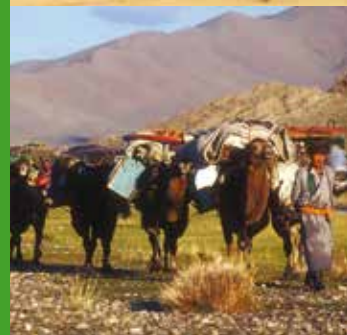
Spain/Morocco

From the deserts of the Sahara to Casablanca, Seville, Madrid, Barcelona – and the wonderful landscapes, food and farming in between.



China/Mongolia/ Siberia

After a number of trips to China and surrounds in recent years, we have come to the conclusion that it is usually better to try for the road less travelled in this part of the world. This tour included remote regions such as Urumqi and Turpan in Xinjian Province of far western China, the steppes of Mongolia, and Lake Baikal in Siberia.



Express your interest by giving Lloyd or David a call on 07 4659 3555 or email travel@greenmountpress.com.au or visit www.greenmounttravel.com.au



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